

Aviation Week & Space Technology

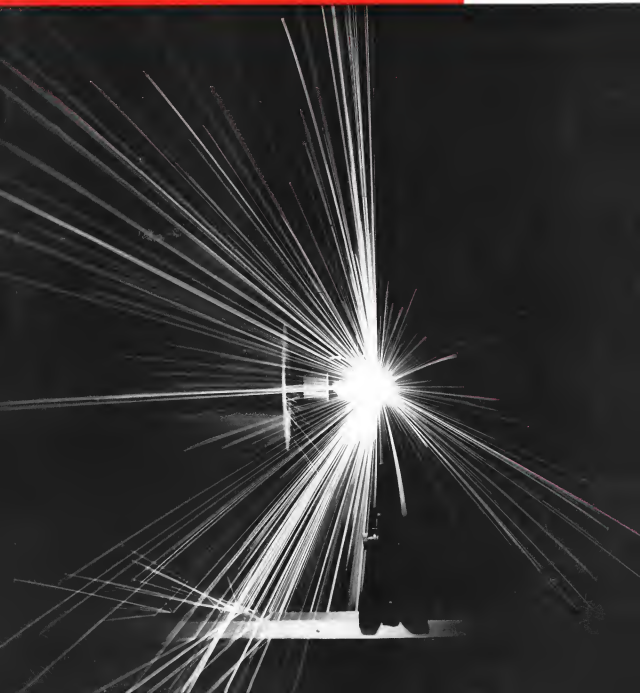
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December 24, 1962

**IMCC to Direct
NASA Manned
Space Flights**

**Hughes Laser Drills
Hole in Tantalum**



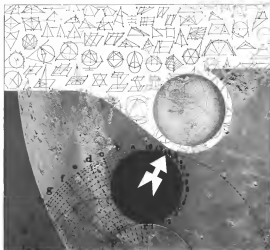


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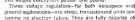
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(Continued from page 5)

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Volume 77
Number 26

PROCESSING — Brian G. Smith, 6
Robert E. Smith, 6

ANALYSIS — William Murphy, 16

SPACE TRAFFIC — David R. Smith, 24

GENERAL DESIGN — David R. Smith, 24

DESIGN — David R. Smith, 24

DESIGN — David R. Smith, 24

DESIGN — David R. Smith, 24

DESIGN — David R. Smith, 24

DESIGN — David R. Smith, 24

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Aviation Week & Space Technology

CONTENTS

December 24, 1962

SPACE TECHNOLOGY

MAKING SUCCESS HARBOR BY DATA DISPUTE 16

Guidance to Improve Satellite Specifications 16

JPL Undergoes Major Shakeup 17

Range Program Criticized by Board of Inquiry 17

Interim Report: Many Probe Data Claimed 18

Naval Considered for Const. Post 19

RA-9 Flight May Last 24 hr 22

Explorer 16 Provides Excellent Micrometeoroid Data 23

Star Space Bombers for Success of Sat 24

Construction of New Test Stand Delayed 25

House Unit Urges NASA to Assume Large Solids Program 26

Space Control Center to Open in 1964 32

AIR TRANSPORT 35

ALTA DRIVES FOR EARLY SHORE HAUL TRANSPORT 35

Boyd Wings Mailbox on SAC 111 Purchase 36

Pass Air, TWA, Fly Manger Plot 37

Summer Atlantic Ferry Transported Mailbox 39

Trunk Line Expected to Break Even With 8% 1962 Traffic Increase 39

Sandstone News on American, Yang 990s 32

Airline Observer 34

Shanties 34

ARCHAEOLOGICAL ENGINEERING 35

ARMED HELICOPTERS PROVIDE ESCORT FOR TROOPS IN VIETNAM 35

USAF Tests KC-130H on Self Field 31

MISSILE ENGINEERING 36

British May Get Polaris Instead of Skybolt 30

British Accelerate F5E 2 Due to Skybolt Uncertainty 21

Redesign Missile Underpins Extensive Testing 19

Modified Jet Cell Tests Missile Motors 56

AVIONICS 37

MICROCIRCUITS SLASH SIZE OF COMPUTER 42

Lower Noise Hides on Rough Simulations 46

Genhuk, KAP Will Use Radar Simulations 43

Filter Caster 51

NAVIGATION 38

BOEING, IAW AWAIT ADVISORY BOARD REPORT 22

Who's Who 13

Industry Observer 13

ENGINEERING 39

ANTONOV SCORES SOVIET SPORTS AUTHORITY 72

EQUIPMENT 40

MARINES TESTING 'PACKAGE AIRFIELD' DESIGNS 67

SAFETY 41

MISSING SAFETY WIRE CAUSED ELECTRA CRASH 77

Washington Roundup 15 Letters 94

News Digest 27 Aerospace Calendar 5

EDITORIAL

Search for 1963 11

COVER: Hughes Aircraft Model 4000 radio beam finds a hole through a sheet of tantalum in a burst of ion flow in a millisecond. Airship shape of tantalum is 3000. Photos of other items listed by Hughes Aircraft Systems Group, Palmdale, Calif., left on p. 42.

EDITORIAL

COVER: Hughes Aircraft Model 4000 radio beam finds a hole through a sheet of tantalum in a burst of ion flow in a millisecond. Airship shape of tantalum is 3000. Photos of other items listed by Hughes Aircraft Systems Group, Palmdale, Calif., left on p. 42.

Laurels for 1962

Q.

What's new in the semiconductor industry?

A.

What's new at Fairchild?

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SEMICONDUCTOR

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The pattern of basic changes in the aerospace industry that we forecast for this year (*AWT* Jan. 1, p. 11) certainly materialized, with some major surprises such as Cals added to the predictable trends. The economic and technical shifts in 1962 occurred during a period of continuing acceleration for the aerospace industry both in civil and industrial capabilities and point toward a year of peak activity during 1963. This process of reacceleration during 1962 produced less than a bumper crop of the type of achievements that we traditionally pay tribute to as this page at the year's end, but it indicates some excellent vintage years ahead.

Here are the individuals and organizations that we think contributed efforts of major significance to U.S. aerospace progress during 1962:

Gen. Thomas S. Power, commander of Strategic Air Command, and all of the men under him for their performance in effectively containing the nuclear deterrent power of this nation during the Cuban crisis. Greatest tribute to the effectiveness of this performance was paid by the USSR's Nikita Khrushchev, in his recent Moscow speech defending his abrupt reversal of Soviet missile warnings from Cuba, when he warned his Chinese allies that contrary to their belief, the U.S. was not a "paper tiger" but had "nuclear teeth."

John Glenn, **Scott Carpenter** and **Wally Schirra**, NASA astronauts, for their successful orbital flights in McDonnell Mercury capsules, which qualified the growing U.S. capability in manned space flight and laid the basic foundation for the Apollo moon mission.

Dr. Hugh L. Dryden, deputy administrator of National Aeronautics and Space Administration, and **Dr. Edward Weick**, executive secretary of the National Aeronautics and Space Council, for simply being who they are and doing what they have done.

John Hootsik of NASA's Langley research laboratory for his development of the lunar orbital rendezvous concept now accepted as the primary U.S. method of attempting to achieve manned landing on the moon before the end of this decade.

Clarence (Kelly) Johnson of Lockheed Aircraft for his continued ingenuity in the "Skunk Works."

Byron Gordon McNall and the General Dynamics/Astronautics crew for launch at Cape Canaveral for their tremendous five-year effort on the Atlas ICBM test program, completed this year, and their bold success in 1962 with the Atlas as a space vehicle booster for Mercury, Ranger and Mariner.

Lt. Gen. Thomas Gentry for his indelible and effective reacceleration of the site activation program for the USAF ICBM program during its most critical phase when he was head of the Ballistic Systems Division of Air Force Systems Command.

E. F. O'Neill, **A. C. Dickinson** and their team of Bell Telephone Laboratories scientists and engineers for breaking, launching and successfully operating the Telstar communications satellite with corporate funds and

demonstrating the tremendous potential of space communications.

Col. Arthur C. Lowell, USMC, head of the Navy's BuWeps research division for his leadership, often controversial efforts to accelerate application of new nonconcurrent construction techniques in Navy expansion, thereby providing insights required to move the promising new technology out of the laboratory into practical operational use.

C. T. Woolman, president of Delta Air Lines, who at the age of 73 is still demonstrating new managerial tricks to his younger competitors in the jet age that result in passenger comfort and profits.

Dwaine Walburn, president of Cosma Aircraft Co., for the managerial talent that has built an organization that this year led the business aircraft industry in sales volume and new deliveries for the sixth consecutive year, delivering more than 1000 aircraft and light helicopters, which comprised about 45% of the industry's unit deliveries and 50% of its dollar volume.

Jack Kilmer, Delta passenger manager at Douglas Aircraft Co. and **Gay Hanning**, Delta branch chief at Cape Canaveral, for the continuing reliability of the Thor-Delta space launch vehicle. Thor-Delta placed nine intercontinental ballistic missiles into orbit during 1962, enhancing its reputation as the most dependable U.S. space booster.

John Stock for many things, including his leadership at the NASA Langley Research Center from that developed the variable sweep concept into a practical application for the F-104 fighter design competition, and speaking some stringent words at the Wright Brothers Memorial Dinner on the future role of aircraft that dissuaded much of the enthusiasm at the traditional speaking program.

Those Boeing C-119 squadrons in Military Air Transport Service serving with the 1611th Transport Wing at Alameda AFB and the 1301st Transport Wing at Travis AFB for their unending demonstration of the value of high-speed jet airlift in all of the international crises during the year.

Jack Jones, **Robert Parks** and **Fred Koehnhafer**, top managers of NASA's Mercury program, and all of the people stretched from Cape Canaveral through Jet Propulsion Laboratory, Wallops, Wallops Island and John F. Kennedy, South Africa, whose overcast skies during the 109-day flight period at Mariner 2 contributed to the success of this deep space probe to Venus.

Maj. Jack Albert, Air Force Systems Command Space Systems Division, for his work in whipping the Atlas Agena combination into a reliable space booster after the first two Ranger losses.

T. A. Wilson, Boeing Co. vice president and manager of the Minuteman branch of the company's aerospace division, for his work in getting the Minuteman into its first operational roles, ready for combat less than two years after the first test flight of the solid-fueled missile.

—Robert Holt

Mariner Success Marred by Data Dispute

Venus fly-by produces high-quality telemetry but argument arises over method for releasing results.

By Edward H. Kolman

Washington—For Propulsion Laboratory scientists are quickly analyzing data on the velocity temperature and atmospheric characteristics of the planet Venus, which was obtained by Mariner 2, but how and when the highly significant information will be made public was the subject last week of a fundamental disagreement within the National Aeronautics and Space Administration.

Mariner 2 flew past Venus Dec. 14, reaching a closest approach point of 21,994 mi.—within 480 mi. of the predicted sun distance—at 2:59:28 p.m. EST. Despite a number of potential failures right up to trace of the closest pass, the payload made three complete radio transmissions of the planet and returned 42 min. of what was called exceptionally high-quality telemetry data.

This data is the heart of the Mariner 2 mission objectives, because it contains the first close measurements of the environment surrounding the planet and the temperature of the atmosphere and surface.

Although some of the quick-look results of the Venusian magnetic and radiation fields had been completed a few days after the fly-by, the best of all report will not be made until Dec. 26 at the annual AAS/AASU for the Advancement of Science meeting in Philadelphia. It will be brought up at Dec. 27 and 28 at an American Geophysical Union meeting at Stanford University in Palo Alto, Calif.

Most significant part of the planetary information—radiation data on the Venusian surface temperature—is expected to be released at a press conference next week at Washington.

This unusual method of releasing information, rather than making it available to the public as quickly as the findings are made, is a compromise between scientific and public information officials at NASA.

The scientific position is that top researchers should not be attracted to NASA projects if the agency does not follow what scientists consider the best long-range rules. To ensure their rules apply, that an experimenter does not contract publicly on his equipment until the results have been published in a reputable scientific journal. The reasoning is that publication in such a journal indicates that data, observations and other scientific publications are of high quality and represent professional design.

The opposing view, which has gained force among the younger experimenters in the space program has grown, is that scientific findings are the results of creative, unprejudiced projects and should not be confined to a limited number of scientific journals which

often have long lags as to such as in words, letters, submission of an article and publication.

Comments which have been reached within NASA at that acceptance of an article in a scientific journal now can be made, publication and the experimenter is free to talk about his findings at the time of acceptance—even though the article will not appear for some time. The compromise was reached by Dr. Homer E. Newell, NASA's senior vice director. Dr. John F. Clark, his associate director and chief scientist on one side, and Dr. George L. Simpson, Jr., assistant administrator for public affairs, on the other.

Despite some to a head because of the annual public interest in Mariner 2 atmospheric data, which were the most important to date in the space program. A few weeks before the Venus encounter, Dr. Newell wrote to each experimenter and asked that he not contract on his findings until approval is reached on their release.

Despite the administrative disagreement, Mariner 2 succeeded in its mission by carrying near best data which exceeded better design limits, two failures of the electronic programmer to start the scanning experiments, and an indication that the first scanner was inoperative. Programmer was apparently turned on by ground command, and the indication that the first scanner was out proved to be false.

The payload is still in danger of early failure because the temperature of the cooled liquid battery was rising last week at Mariner missed the closest point to the sun. This point, called the perihelion, will be reached Dec. 27, when Mariner will be 45,000,000 mi. from the sun. Aphelion, or most distant point from the sun, will occur June 18, 1964, and will be 113,811,000 mi. from the sun. Mariner's distance from the earth will drop May 18, 1965 at a distance of 95,083,595 mi. Next closest approach to the earth will occur Sept. 27, 1965, at a distance of 24,761,717 mi. The payload velocity around the sun over 344.9 days.

Goddard to Improve Satellite Specifications

Washington—Goddard Space Flight Center expects to avoid such concerns for new satellite programs in a new draft, revised technical position areas and their present more detailed and realistic specifications for subsequent hardware procurement.

The new policy is drafted in the Defense Dept.'s recently adopted policy of fast moving program definition phase contract. This was disclosed by Eugene W. Wawerski, assistant director of the National Aeronautics and Space Administration's Goddard facility.

Wawerski said he hopes that the more detailed and better defined specifications will enable some companies to design that they do not have the required capabilities, thereby saving themselves the cost and effort of making a proposal.

He noted that earlier launches and satellites had imposed a main source in reliability since 1955, when only 30% of the payload had reached sun into orbit, whereas this year the percentage was 70%.

In fact, Goddard's Goddard in 1961, a lot of time was successful while this year 40 11 attempts have achieved orbit.

But then, he has been in great agreement in the stability of spacecraft programs, Wawerski said. "Where we had before of two to three months at this time, we are now in reaching a level of four to five months and higher in 1962," he said.

He noted that 40 11 attempts of nearly five months and Tikhon's list of about five months.

"But it is obvious that there is much to be done if we are to provide the kind of mission which will be required in some of the satellites which are presently being designed," he said.

Successive Failures Precipitate JPL Shakeup

President, Civil-Opt. Propulsion Laboratory, manager of National Aeronautics and Space Administration's manned lunar and planetary program, has undergone a far-reaching shakeup in the wake of five successive lunar spacecraft failures and in anticipation of criticism of its management by NASA's lunar program. The JPL's lunar program is the last of the lunar program.

As a consequence of the shakeup, the lunar program director, Dr. C. C. Cunningham, and the manager of the Ranger project, James D. Brainer, will be reassigned to other parts within JPL.

Ground-based lunar and planetary project office has been at the center of the shakeup. Dr. C. C. Cunningham, who formerly headed the planetary program office. This new office will report directly to Dr. William H. Pickering, director of the observatory, as did the lunar and planetary program office which it replaces. As former planetary program director, Pickering had several changes of mind. JPL's major lunar spacecraft mission since it became a NASA contract in 1955.

Reporting to Pickering will be the project's project manager. They are:

- Ranger—Hans M. "Bud" Schriener, who serves as the system director in the Ranger program, is being replaced by Dr. Charles G. Brown, former chief of the system analysis office of the program.
- Surveyor—M. E. Gibson, who continues in the position.

and prior to the assignment of a Mission Manager, J. N. Jones, who has been managing the Mission 2 spacecraft under Pickering.

• Voyager and advanced development projects—P. N. Plesch, who continues in this position.

Cunningham has been temporarily reassigned to Dr. Pickering's office with a special assignment to meet Pickering in the inspection of the combined lunar and planetary office. Brainer will be a special assistant to Schriener.

Changes recently were the result of recommendations made by a special JPL review committee which completed its report on the management of NASA's Lunar Observatory (AW Dec. 28, p. 10) which conducted the Ranger investigation.

JPL's telecommunications division, still a long way from a more complete in the lunar and planetary program changes. Representatives of the review system in the division will be reported. 1. Randolph, who had reported in the division of the communication system development section, probably will head one of the unassigned sections.

There have been criticisms both within NASA and in industry of certain aspects of the management of the division's Ranger-Space Instrumentation Facility, together with the division's handling of recent procurements.

Telecommunications changes are interpreted partly as a move to meet requirements of these criticisms.

Every day that Mariner 2 continues to fly, it establishes a new space communication record. If the probe survives, it has been estimated that communications will continue for at least three months, which will place it more than 95 million mi. from earth.

Date Reduction

Data reduction is continuing on the interplanetary experiments, which have been completed and then preliminary results reported. These experiments consist of a magnetometer, high energy electron experiment, solar plasma detector and cosmic dust detector (AW Dec. 15, p. 30).

Magnetometer instrument experiments covered electromagnetic radiation at 15 and 19 cm wavelengths. The lower value is at the lower observation band, and the higher one designed to penetrate the Venusian atmosphere to determine solar emissions from the planet at high in 15 cm. The theory is that the surface of the planet is that hot or that the atmosphere is that hot because of a greenhouse effect.

Compasses infrared observations, operating at 15 and 19 cm wavelengths, looked at the Venus cloud cover to try to find bands in the cover.

AW&ST Schedule

Airline, Work and Space Technology will publish its next issue Jan. 7. The current issue is the fourth one in the series. The Dec. 18 issue, which was the last of the series in December, will not be published.

Quality Control, Design Criticized by Ranger Program Investigators

Washington—Ranger spacecraft launch leading spacecraft program has been criticized for its quality control, design and test procedures in a report by a board of inquiry convened after the fifth encounter failure in the program.

Most of the board's findings are a shakeup in the top program management at Jet Propulsion Laboratory (see box), an internal checklist procedure and removal of Ranger 1 from the JPL's Ranger 6 spacecraft, which had been scheduled for launch early next year, will be used in a general product improvement model in order to test to correct the shortcomings which the probe had experienced. Modifications developed in the Ranger 6 ground program will be made to Ranger 7, 8 and 9 at the expense of several months delay in the flight program.

The inquiry board (AW Dec. 28, p. 30), submitted a final report on Dec. 4 in addition to the general conclusions on quality and design, the report contained the findings of all major flight schedule changes, the matters were considered fully. Right now.

Both JPL and NASA were under heavy pressure to meet launch schedules because of heavy competition for launch and time at Cape Canaveral, and because spacecrafts are being delivered at a rapid pace. There is only one part available for Ranger launches. Arpa

must be maintaining the schedule, is that NASA has been forced to re-evaluate its quality control and test procedures. The JPL's Ranger 6 program is based on the Ranger concept and contains some components developed for Ranger, the agency pointed out.

Most of the NASA report is secret because it contains design data on the Atlas and Agena boosters which are being used in the Ranger program. The launch schedule was generally set by the JPL's Ranger 6 program, which had been scheduled for launch early next year, will be used in a general product improvement model in order to test to correct the shortcomings which the probe had experienced. Modifications developed in the Ranger 6 ground program will be made to Ranger 7, 8 and 9 at the expense of several months delay in the flight program.

In House E. Newell, NASA space systems director, said the next step for Ranger will be an intensive, combined design review and test program. Ranger 7 flight, probably will not be scheduled until the review is completed. Ranger program has become a critical part of Apollo.

Inquiry board was headed by Dr. Albert Keller, a NASA astronomer as well as to NASA. The board consisted of three representatives of NASA headquarters, Thomas Logan of Goddard Space Flight Center, John Foster of Ames Research Center, Frank Smith of Langley Research Center, P. J. Dwyer and Dr. Arthur Randolph of NASA's Systems Center and John Harebeck of Bellcom.

Slim Hope Remains for Success of Relay

By George Alexander

Cape Canaveral-Space agency officials maintained a slim hope last week that power might eventually hold on in the Relay 1 spacecraft to the point where communications experiments might be possible, but only tests of the telemetry system had been conducted through Dec 21.

Disappointing operations of the payload followed a series of external power-hogging by a Thin Delta vehicle which placed the communications telemetry into an orbit sagging from 319-64 mi. to 481-15 mi. in a period of 3 to 5.99 sec. Flashed orbit was 700-4,900 mi. with a period of 31 to 4 min.

Abnormal power drain apparently occurred each Dec. 14 between the 8th and 9th orbits. On the fifth orbit, Relay exchanged signals with the Naval Research and Space Administration's test station at Wallops, N. I., but the on-board voltage was too low on the sixth orbit to activate one of the two transponders necessary to conduct

planned communications experiments.

The power remained low throughout the first week, and NASA was attempting to determine the cause of the failure through analysis of telemetry data. The 171-lb Relay satellite, built for NASA by Radio Corp. of America, was successfully launched one orbit by the three-stage Thor Delta vehicle at 5:30 p.m. EST Dec. 11. The Douglas-built vehicle missed its scheduled launch time by only 1 sec, and now is in a series of increasingly orbiting 14-minute peribolus after an initial failure.

Plans had called for Relay to transmit telemetry in two telephone, teletype and teletext channels. The first two channels and other data experiments between the American Telephone and Telegraph Co.'s Andover, N.H., ground station and the British General Post Office station at Gouletville, Devon, and the French National Centre for Telecommunications Studies established at Plouzanet-Brest.

The two-way telephone, teletype and data experiments are to be conducted through the International Telephone & Telegraph Co.'s Naples, N. J., station and the Brazilian station at Rio de Janeiro, connected by Radio International de Brasil. Downward, coast and teletype transmissions were to have been conducted by U. S. and Brazilian stations in the Italian station at Palermo, operated by Telegrafos Italiani station had the capability to receive, but not to transmit.

Volatility between stations was attributed to have been between 15 and 50 sec. for each of the satellite's three daily passes. Global reception of Relay was 47 deg., so the satellite does not always pass just above the equator participating in the program. Relay was equipped with two advanced transponders to cut either message allocation.

The satellite was to receive and retransmit (teletext) signals from ground stations at 3,271 mi. and repeated by one of the transponders selected by the ground station at 4,173 mi. (Narrow-band telephone, teletype and data transmissions were to have been on frequencies at 1,735.6 mc. (station-to-satellite) and 4,165 mc. (satellite-to-station) when the spacecraft was passing overhead in a westward or west-southward direction, 7,723 mc. (station-to-satellite) and 4,175 mc. (satellite-to-station) when passing in an eastward or south-north direction.

Navarhah transponders could accommodate 120 two-way, or 300 one-way telephone channels. Relay also carried two command screens (superior model 445 mc.), two command decoders, two telemetry transmitters (136 mc.) one telemetry receiver and one command control unit. Teletext beamed

was to have operated continuously at 3,030 mc.

Temperature control of the satellite was maintained by a series of standard Muller stations across the broad end of the spacecraft. Structures were actuated by a bellows-type piston filled with liquid sulphur dioxide. Heat was caused the liquid to expand and displace the piston open. Designed temperature was maintained at 40° to 50°.

• **Satellite experimenters** stated, saying • **Relay coil damage.** Of the 3,215 coils covering the spacecraft, 30 were out of order for this experiment. Nine were of the Non-F variety, nine were Po-N, and there were 10 gillies around. Shocking caused from static to static plates, saving in thickness from 30 to 60 mils.

• **Diodes.** Six diodes were to be exposed to solar radiation during launch and in orbit. Thirteen connected to the diodes were to indicate temperature rise of the sun and show this data, damage could be inferred.

• **Radioisotope.** The device, built by Bell Telephone Laboratories and State University of Iowa, was installed as a close-knit aperture in the side of the spacecraft and was to sample pulsations between 15 and 300 m.e., and 51 m.e. and 15 and 60 m.e., and electrons between 0.5 and 12 m.e.

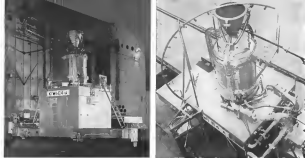
The REL part of the unit was to sample electrons between 0.25 and 1.0 m.e. and pulsations between 2.25 and 25 m.e.

Relay was the first payload to be launched by the improved Thor vehicle (AW July 2, p. 112). Second stage length was corrected by 5 in., adding about 1,300 lb. in payload capacity to the unit. Coupled with the squaring of the first stage engine from 150,000 lb. to 172,000 lb., thrust (adding with Delta 171, and total) of the vehicle has been increased from 506 to 840 lb. in a 508-in.-high earth orbit.

Relay 3 Solar Cells

Wallops-Relay Corp. of America has received an \$600,000 contract from the National Aeronautics and Space Administration to provide Non-F relay cells for Relay 1, and for Relay 2. A relay cell is a semiconductor device that converts light energy into electricity. The cells are used in the spacecraft to provide power for the instruments and the transmitter. The cells are made of silicon and are mounted on a substrate. The cells are used in the spacecraft to provide power for the instruments and the transmitter. The cells are made of silicon and are mounted on a substrate.

Relay 1 was fitted with 48 Non-F relay cells, but NASA and analysis of Relay 1 telemetry data led to the conclusion that the Relay was unable to be shut down in the voltage regulator circuit and to maintain stable voltage.



KW-44-A satellite rocket section is shown a few hours prior to firing. The reactor is fueled as part of the Project Rover program.

Construction of Nerva Test Stand Delayed

By G. M. Fletcher

Julius Felt, New—Construction of the test stand for the Nerva nuclear engine at National Aeronautics and Space Administration's Project Rover will not be completed until the spring of 1964, about 15 months later than a target date established last year (AW Feb. 26, p. 65).

First test stage of Nerva (Julius engine for rocket vehicle propulsion) is scheduled for late 1964.

Work on Engine Test Stand No. 1 at the Nucleon Rocket Development Station, which will be used for the first Nerva ground test, will be completed by the end of the year. The station, which will be completed by the end of the year, will be used for the first Nerva ground test, which will be completed by the end of the year. The station, which will be completed by the end of the year, will be used for the first Nerva ground test, which will be completed by the end of the year.

Other problems encountered in the Keri-44-A reactor testing program of Project Rover, designed to develop a liquid hydrogen-neutron rocket engine for space applications, include:

• **Laboratory of hydrogen** is liquid hydrogen temperatures (—423°) is a serious hazard.

• **Feeding** of hydrogen into the reactor unit which will maintain strength at cryogenic temperatures in relative field.

• **Flow problems** from vibration, which causes shaking, flow oscillation and moving of the liquid fuel level.

• **Refueling** problem concerning re-

actor handling and testing, requiring development of new equipment and control techniques.

Demonstrative that a nuclear core using liquid hydrogen as the propellant could be successfully started was made Sept. 1 with a Keri-44-A test vehicle.

On Dec. 30 a test run of Keri-44-A lasted 350 sec. before it was shut down when fuel was exhausted in the exhaust flame. Test observations indicate that the control system showed no signs of instability in reactor operation. Possible cause was not leakage or radiation vibration, but fuel analysis is awaiting results of the neutron core.

Nerva engine is being developed by Aerojet-General Corp. for the Space Nuclear Propulsion Office (SNPO), a unit, National Aeronautics and Space Administration. Aerojet, Clearwater, Fla., is the lead contractor. A Lockheed-Hughes consortium will be used, according to Aerojet officials. This type of nuclear core is a technique for using hydrogen gas to drive a turbine, which is then, driven a liquid-hydrogen pump.

Relatively and gaseous hydrogen, which has been warmed slightly by radiation through the jacket of the reactor vessel, will be mixed with hot hydrogen gas trapped from the throat of the motor to drive the turbine connected to the liquid-hydrogen pump. After passing through the turbine, the gas will be exhausted through a divergent nozzle to provide thrust for the vehicle. Pritch and was control will be provided by moving the entire engine

at a gradual pace between the turbo pump and the propellant tank.

To provide thrust for the Nerva engine, the liquid hydrogen from the turbine-driven pump will be controlled through the motor jacket to a cold direct neutron reflector surrounding the reactor core and dry through the core in shield on top of the motor. After passing through the shield, which contains moderators to the control area, the hydrogen gas passes through the reactor core where it is heated and accelerated through the exhaust nozzle.

Next step in the Nerva program will be development of 10th (reactor in flight-test) rocket stage employing the Nerva engine for propulsion. NASA has selected RLH as the third stage of the Saturn C-5.

First launch, said program officials, could be in 1965 if launch delays does not slow the program (AW Dec. 17, p. 25).

Program calls for 10 RLH stages to be built. First two stages back will use liquid hydrogen and will be tested at the National Rocket Development Station later. Next three stages will be flight configurations and will also be used in the static test program at the station.

Last four RLH stages will be flight-tested from Atlantic Missile Range from Launch Complex 36, which also will be used to test the Saturn C-5. RLH launch vehicle will consist of Saturn 80C on S-2 and S-2 delta stage and RLH stage powered by Nerva engine.



ANTENNA FOR RELAY, built at Mojave, Calif., by Radio Corp. for NASA, mounted on X-Y stand, and provides wide-band communications transmission and reception equipment. Structure is 45 ft high, 38 ft across at the base and 40 ft across the dish. Field angle is 145 deg.

New Local Carrier Aircraft Drive Begins

ALTA group studies proposals for inexpensive, short-haul transport; Bede BD-7 design appears favored.

By L. L. Doty

Washington—Area, of Local Transport Airlines last week launched a drive for early procurement of a short-haul, low-cost transport aircraft which area local service airline officials believe is essential to the survival of their industry.

Although the local service group is still divided on the exact need for such an aircraft and the specific local carrier aircraft design to play in the carrier's air transport system, it appears likely that the industry will soon take firm action toward adopting an airplane that, for the first time, would be specifically designed for local service requirements.

The drive is headed by Leslie O. Brown, president of Altkana Airlines and chairman of the ALTA (Local Air Transport Association) board. Brown invited experts and aircraft manufacturers to discuss with local service officials to develop a need for an aircraft that would serve low-to-medium-range air transport operating needs.

Last week, Brown stated an airplane group to study proposals brought forth during the discussion and make recommendations to the design committee. The committee, in turn, will prepare a final recommendation from the advisory group's findings and submit the first paper to ALTA membership by August.

The advisory group consists of R.

Douglas Spencer, airline engineering and operational consultant, William Littlewood, Altkana Airlines vice president of equipment research and Dr. Joseph L. Cornish, a specialist in the field of low-density line control at Mississippi State University. Melvin Gough of the Federal Aviation Agency will be available to the group for consultation.

These are the chief contenders for the ALTA choice.

- **French built Breguet 540** transport, powered by four Turbomeca Altus turbo-prop engines. Plans to bring such to the U.S. by Turbo-Flight Inc., Chicago, Ill., will carry between 16 and 24 passengers.
- **French Mo-Habit MRH-26** Super Beechcraft light transport, powered by

two Rotax 4 turbo-prop engines. It will carry between 20 and 18 passengers.

- **U.S. built Bede BD-7** transport, powered by two General Electric T-75 turbo-prop engines driving a single shrouded stream-tube propeller. Plans will be equipped with leaders for air control, and will carry between 15 and 24 passengers.

Although these aircraft and six other contenders still undergo objective study by the advisory group, it appeared early in the study that the industry carried and the considerations that the BD-7 more closely to meeting the current needs.

In its presentation, Brown and the industry said nothing an aircraft that could operate in less than two cents a seat mile, one-stage lengths not to exceed 100 mi., and carry about 25 passengers at an operating cost of less than 40 cents per passenger mile.

He said that he did not feel that STOL characteristics were necessary, but he called for approach speeds of between 35-45 mph. He said passengers at the order is desirable but not "an absolute must." He did want that the plane be equipped with adequate heating and air conditioning system.

James Beale, vice president of Bede Aircraft Co., said that the 100-mi. stage lengths, meaning an altitude of 15,000 ft. replace cost per mile of the BD-7 will be \$6.64 cents. The aircraft will cost about \$500,000 to build.

He said that a maximum weight of the airplane will be 12,000 lb. and its useful load will be about 110% of its empty weight. It will carry a relatively low passenger load in proportion to its payload capacity, he said. He added:

"Our projections are that your fleet would need 24 people and a sufficient amount of fuel to these 100-mi. segments will require a 45-gal. tank at 15,000 ft. occurring at the end."

Bede said it will accommodate an approach speed of 65 to 70 mph and a takeoff and climb-out speed of 70-75 mph. He added that the aircraft can climb a 30-ft. altitude in less than 500 ft., at full gross weight, on a 100-gal. horsepower day. He said if half the power is lost, only 30% of the climb thrust is lost, and therefore, acceleration and angle of climb is "well sustained."

Bede said his firm's experience with boundary layer control (BLC) used as an experimental model now flying with respecting engine power, his design-

ated that BLC requires a scheduled small amount of power and does not induce unusual pitching moments. He said that it does not add a huge amount of weight to the wing, which could produce undesirable lateral, he said, it reduces lift curve slope, permit wing to operate at an extended cruise over lift of conventional wings.

Don Patton, president of Turbo-Flight, said that the Bede 540 costs have been placed at 10 cents per passenger mile at 100-mi. stage lengths, at a cruise speed of 150 mph. He said the plane's acceleration is 15 ft/sec. and 1,500 ft/sec. in its rotation speed of 50 in. climb speed. He said, at 100 mph, approach speed is 50 ft/sec. and takeoff speed is 65 ft/sec. He said that the "new small aircraft" with the combination of the four propellers over a high performance wing design produce a laminar flow effect.

Patron, president of Turbo-Flight, said the Super Beechcraft operating costs have been set at two cents a seat mile on stages of 30 mi. average, with a price of \$1,500 to \$2,000 per unit. Operating costs per passenger mile are set at 100-mi. stage lengths, 40 cents.

Citing the need for the short-haul service, Brown said some airlines are in danger of losing service unless such a plane is brought into scheduled operation. "If you applied such a plane in Oklahoma alone, only two cities in all Oklahoma would still remain a service Tulsa and Oklahoma City," he said.

Brown said the first level of service for local service carriers was in operating schedules to meet intermediate cities or routes leading into connecting trunkline hubs. He said that the industry had never adequately fulfilled this service because "we have not had the airplane to do this."

He said that local service airlines which he termed "super local" were now operating non-scheduled operations, or service in the short-haul high traffic density markets which have been curtailed by the trunk carrier. He said he felt that there is a need to develop service carriers outside this field, but stressed that local service carriers cannot afford to share a "progressive manner of the original plan for which local service carriers were conceived."

Constellation Crash

Washington—Loss of an AN-7521 jetliner that fell from the path of the flight of the above boat system was the probable cause of the crash of a TWA Lockheed Constellation on Chesapeake Bay on Sept. 1, 1961, the CAB said last week.

All 71 persons aboard died in the crash of the Constellation. The Board said that the manner in which the boat was lost as a "matter of opinion."

Pan Am, TWA File Merger Plan; Hughes' Interest Reduced to 29%

New York—Year-long negotiations between Pan American World Airways and Trans World Airlines culminated last week in formal approval of a merger agreement, the plan was announced by the two airlines.

New company would be called Pan American World Airlines, Inc. James T. Frayne, chairman of Pan Am, president of the board of directors, and Charles C. Willingham, Jr., head of TWA, would be president.

Under the merger plan, TWA stockholders will receive one share of stock in the new operating company for each share of TWA they now hold. Pan Am stockholders will receive one share of stock in the new operating company for each share of Pan Am they now hold.

The merger would create a new airline, Pan American World Airlines, Inc., which would be a holding company for the two airlines.

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Under the merger, the percentage ownership by Howard R. Hughes, who now holds 35.2% of TWA's stock, would be reduced to approximately 29% of the new corporation. This plan for dealing with Hughes' stock was first disclosed by Aviation Week & Space News.

Merger negotiations would have a 25-month history, with the selection made subject to further agreement. However, the merger plan calls for 15 to be reduced to 10% of the new company.

TWA, if any other agreement can be reached by the closing date.

Major stockholders of the company, the CAB President Kenneth C. Sullivan, said that the merger would be a "progressive manner of the original plan for which local service carriers were conceived."

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the stock is a merger. Even so, Hughes could still fight the merger in the courts by contending that the trustees failed to protect his interests properly.

Those currently controlling TWA, however, say the merger might have some of the problems the carrier faces. One special trouble was a TWA's debt service division, where TWA's crippled by lack of activity in competing with its two main rivals, American and United.

TWA currently has 70 jets, including 50 727-100s being added on lease from Boeing. But 13 of these, costing \$20 million each, will be devoted directly to international operations.

With these it must compete against American's 80 and United's 87 jets.

Hope of closing this gap with fewer aircraft and lower operating costs is being ordered only 15 Boeing 727s as approved to American's purchase of 40 and United's of 15 TWA did plan a \$100,000,000 order in 1961 for 30 747s.

However, which will have given it a boost in the high-density markets out of the Mississippi. But the order was cancelled following failure to complete financing arrangements.

Lack of activity on west TWA's gate was needed to obtain key markets, such as Los Angeles, San Francisco and Cincinnati. In October this year, seeking to achieve service for markets where TWA's routes were weak, it announced its transcontinental nonstop frequencies from New York to Los Angeles to three daily, and New York to San Francisco to two, a drop of one service to each city.

It is still an international operation. Pan Am's 55 jets, plus DC-8s and Boeing 707s, plus 10 piston aircraft. Major with TWA would provide a total 135 jets and 10 piston aircraft, plus a 57-plane cargo fleet that would include three Boeing 707-320Cs now on order to Pan Am.

Consolidating the two carriers' financial assets in the first 18 months this year, Pan Am had revenues of \$454,200,000 and a net income of \$10,246,000 after taxes. TWA, with \$335,351,000 in revenues, reported an after-tax loss of \$6,734,000.

Merger with TWA would also attach Pan Am's interest in airlines to enter the U.S. domestic market, making it the largest carrier in the world. It would also take the form of a merger of two points in the continental U.S. Also, in joining with its primary North Atlantic competitor, Pan Am would gain service rights to routes into Tokyo, Osaka, Manila, Hong Kong, Taipei, Seoul, Guam, Dhaka and Bombay.

Boyd Warns Mohawk on BAC 111 Order

Washington—Chief Executive Robert E. Boyd, head of the Boeing Aircraft Co., said that BAC 111 jet transport aircraft is not the airline's choice and approval of BAC 111 jet transport and suggested the carrier to consider its requirements.

In a letter to Mohawk President Robert E. Boyd, Boyd said that the plan to introduce the large plane into scheduled service as "transport with substantial risks, particularly in the light of the low average load factor of the local carriers." He noted that the Mohawk had been in service at 40%, compared with the 10% reported before it acquired its fleet of medium passenger-Cessna 440 transporters. Boyd said:

"Under these circumstances it is my personal belief that a program for acquisition of large jet aircraft such as the BAC 111 is, at least, premature."

Boyd said the need for such aircraft in local service areas has not been demonstrated. Such equipment was built to a substantial measure to reduce and "on request" ability to meet other local carrier needs," he said.

Boyd explained that Boeing Aircraft Co. is not only able to fill its obligations, and that the letter said warned that the operation of the BAC 111 will not be considered.

Boyd said last week that prior to the Boyd letter, he had made it clear to the CAB that the purchase of the jet BAC 111 was planned on the assumption that the carrier would not be subsidized by the government. He said that local traffic studies conducted by Mohawk indicated that the airplane would prove profitable and self-sustaining on routes for which there was competition. Earlier, Mohawk had said it would offer service on its high-density routes to the competitive

Summer Atlantic Traffic Topped Million

By James R. Ashlock

New York-North Atlantic traffic on scheduled carriers topped the million mark for the first time during this year's peak low-month summer ten-day period, and offshore programs have been such that volumes for the full 12 months should be up appreciably, 1976.

June, though, September showed 1,123,378 persons traveling between the U.S., Canada and Europe, a 7.4% rise over the 917,574 reported for that period last year (AWN Nov. 15, 1961, p. 42).

Carriers reported 3,010,000 passengers in the first 10 months of this year for a 19.5% increase. Continued increases through November and December by major carriers, such as Pan American World Airways and Trans World Airlines, should maintain the growth average until year's end.

Pan Am anticipates that it will close the year with 443,000 transatlantic passengers in 11% increase. TWA's volume is expected to total 373,506, or 34.3% over 1961.

Load factors during the last-September period, as figured by 17 IATA airlines, averaged 57.7% compared with 55% in 1961. However, airline officials are more concerned by the passenger volume increase of 3.4%, being well over the 15-25% rise in capacity, indicating that 1962 will be a leaner year toward more profitable balance between loadings and available capacity.

Since four quarters of 1961 showed a passenger volume increase of only 53,602 in the face of a 499,634 boost in seat capacity.

Available seats from June through

September this year totaled 3,066,637, compared with 1,741,087 in the same period last year. Scheduled flights in 1961 totaled 15,513, or 4.9% more than the 15,950 flown in the same four months of 1961.

First-class load factors increased for this summer compared with those in the previous season. Only five carriers reported increased second-class load factors more than 18% during June, the peak off-peak travel month. Of the 12,465 flights this year, only 12,490, or 35.4%, were occupied.

However, second-class load factor increased in June was 75.0, with 347, 341 of the 286,105 available seats being sold.

Airline officials credit the new group fares, which became effective in May for groups of 25 or more persons, as a major factor in pushing the summer's volume over the million point. They say for the 17-day season fares, available from October through March, are the best period because this year and helped help up of season business.

No carrier specified just what percentage of its transatlantic passengers traveled under group fares, however. Officials stress that with all the special tour programs now available, plus leisure flights, traffic is carried by TWA and other airlines out proportionately as in commercial bookkeeping lines.

"We have tried to present just how much business was coming from the leisure program," one airline spokesman said, "but we're not to come up with any carrier's figures."

TWA did estimate its 84% increase this year in the number of its passengers traveling under package, that range from \$100 to \$1,000, but does not disclose specific package. Based on these figures, TWA officials said they will concentrate more sales attention in 1963 on major tour operators.

Another development this year is the airline's growing tendency to rely on advance bookings in forecasting upcoming business. Last-summer bookings, as compared to the first-summer capacity increase that came with the year, has now become an established practice rather than a trend, carrier officials report.

"We now look to the advance bookings as more likely to be a reflection of how the travel picture will look for emerging weeks," said a spokesman for Lockheed. "So when we travel we are buying tickets at the last minute that we can't rely on our own advance bookings for in forecasting." Carriers anticipate that 1963 will bring further passenger volume in

crease. Capacity will also rise slightly, with Pan Am, for example, planning a 17% increase world in flight frequency during the summer. This year, Pan Am has had 184 jet flights weekly to and from Europe. TWA will also schedule more flights, adding five Boeing 707-319Rs in its present transatlantic fleet of 11 707-120s.

However, the overall capacity increase will not be as sharp as that which existed in 1961, and airlines predict that the percentage of passenger growth next year will again exceed the rise in capacity.

Reports by individual carriers: **• Alaska-Pan Am** volumes for 1962 are 44% above 1961, with load factor improving to 55.5% from 51.5%. It will report a similar increase in operations this year. Spokesmen say 1961 will be a good year, although they expect some moderate passenger increases, probably 15-25%. Alaska will increase over Douglas DC-8s to 40, and will add three flights weekly in each direction to the 24 it operated this summer. **• Pan Am-Pan Am** volume rose a 15-20% increase in passenger volume next year.

British Merge Scored

London-Reports that British European Airways will merge with British Overseas Airways Corp. to combine state-owned (BAW 50%, 40% but work was simply started by Lord Douglas of Kilmuir, BBA chairman.

The deal suggested merger plan here, as the firm has reported in London that it will be merged with British Overseas Airways Corp. to combine state-owned (BAW 50%, 40% but work was simply started by Lord Douglas of Kilmuir, BBA chairman.

Lord Douglas said, "The difference between the two airlines is that we transport its increasing and will continue to increase, particularly with the possible introduction of supersonic jets on long-haul routes in the 1970s."

Lord Douglas said that the suggestion that a merger was a possibility would be a very real "threat," and noted:

"The desire to dig up the plant of the airline is stronger and more intense than, which has been going on continuously since the transport had started, must be created. It can only lead to destruction and confusion and in the end can do nothing but harm to the British airline industry."

Lord Douglas' term in chairman's office in December, 1961. He has so far been treated of questions as to his situation in regard to retirement or accepting another term.



Super Freon shown during first flight. Boeing's SA-320 Super Freon heavy lifter is shown being hoisted by a crane on the tarmac of an airport. The 30-passenger helicopter is powered by the first Turbomeca Turmo MC engines (AWN Nov. 15, p. 11).

Super Freon Shown During First Flight

Boeing's SA-320 Super Freon heavy lifter is shown being hoisted by a crane on the tarmac of an airport. The 30-passenger helicopter is powered by the first Turbomeca Turmo MC engines (AWN Nov. 15, p. 11).

which would be in excess of the 11% recorded this year. Increased frequency, plus addition of new service to Baltimore, Washington, is expected to bring about increased Pan Am flights on this year's volume were burned by strike flights in June, just as the latest transatlantic movement was getting under way.

• BACAC—June-September business rose 20% this year with 131,165 persons carried between the U.S., Canada and Europe. BACAC officials say the group fare line has been "difficult" to handle, although it would be difficult to analyze its impact on the market.

• TWA—In the past four months alone, TWA carried 113,611 transatlantic passengers, a 23.7% increase over 1961. Lord Douglas said that BBA's revenue from the growing over-growth industry. Carriers' revenue on the North Atlantic showed a peak of 516,770,000 in first four months, the year compared with a 508,000,000 in the same period of 1961. TWA is forecasting that its international revenue passenger miles in 1962 will rise 12.5%.

• SAS—Traffic increased 18.8% for June through August and 16% for September through November.

• Aerobus—Flying its second full year of transatlantic operations, Aerobus reports passenger volume up approximately 70% on its five flights weekly. It plans no increase in frequency next year.

• Irish-Pan Am—April through September, Irish International Airlines carried 57,755 passengers, a 57% increase over the same period in 1961. The carrier has on hand factor of 67% during this period, the highest in any transatlantic airline. Spokesmen are growing more interested in Ireland as a large factor in

traffic growth, claiming a 70% increase in passenger applications be Ireland-based airlines the year. Irish plans to increase next year in the 14 weekly flights operated between New York-Ireland and Ireland.

• KLM—The Dutch carrier reported a 75% rise in passenger volume for June through November.

• Lockheed—Business in first 10 months was up approximately 10%. Officials term it a "good year, not a very good year."

Business—June through November showed a 17% increase in business's transatlantic traffic over the same period last year. Load factor advanced from 55.4 in 1961 to 55.5 this year. The carrier forecasts a similar traffic increase for 1963.

Airport Management In Russia Criticized

Moscow—Russian newspaper Soviet Kultura has criticized management of Moscow's Sheremetyevo Airport for not acting to correct published criticism. The paper charged that Sheremetyevo is disorganizing planes with empty seats and selling tickets that all spots have been sold.

According to publication, one passenger who had to be transferred from Moscow to Leningrad, was forced to leave his family in the Moscow airport because he was told that only one seat was available. During the flight he counted 37 empty seats. He said the next day's Moscow-Leningrad flight had only 30 of 80 seats occupied.

Sheremetyevo Airport officials said the highest number of empty seats was 100. They admitted that "planes frequently empty." But, they explained,

"there is a lack of coordination between city ticket office and the airport management office. Seats are marked but then aren't occupied."

The newspaper also charged that Sheremetyevo is a customer complaint book and even critics in which passengers complained about flight delays, including confusion and restaurant service.

CAB Probes Wreckage Of Tiger Constellation

Los Angeles—Wreckage of a Flying Tiger Super Constellation 10490 crash plane which crashed near Dec. 16 is being laid out in a hangar at Lockheed Air Terminal in Gardena, California, for an investigation as to whether it occurred as a result of an attempt to clear the plane over the 503 ft. of the glide slope at the time of the crash. Constellation had the ground in a left-wing-down attitude 14 in. short of runway 2, a North Hollywood during an 8.5 approach to Lockheed Air Terminal.

Known, a study was 15 mi due to period observation by the Pilot had been requested and received a current situation report during the approach. Last year, constable was "understandable," OK—the pilot's response to a 2-mile altitude given by the Lockheed tower.

Plane which crashed 25 sec. later, was on the runway heading and approach appeared completely normal up to time of impact.

Pilot was a 40-year-old ex-military man from Los Angeles with 93,660 hr. of general cargo flying.

Eight fatalities included three crewmen, two passengers and three residents of the crash site. Nine hours and three small manufacturing plants were either destroyed or damaged in the crash.

Transatlantic Traffic			
July-September, 1962			
Carrier	Flights	Passengers	
Air France	1,427	93,999	
Air-Indes	128	14,431	
Alitalia	516	61,615	
BACAC	2,204	193,405	
Lockheed	706	65,936	
BOAC	711	20,897	
BOAC	140	7,363	
BOAC	140	33,374	
KLM	1,275	54,775	
Pan American	3,446	213,526	
Qantas	604	6,389	
Sabena	401	41,411	
SAS	925	79,363	
Swire	401	37,746	
TWA	1,997	124,621	
Canadian Pacific	246	18,149	
Trans-Canada	807	56,271	
TOTALS	35,315	1,123,575	

AIRLINE OBSERVER

► Local service airlines flew 116.5 million revenue passenger miles in November, an 18.5% increase over the same month last year. Revenue passenger miles for the first 11 months of the year reached 1.5 billion, an increase of 18.5% over the corresponding period last year. Local factor for the January-November period was 42.6%, compared with 41.7% in the same 1981 period.

► There were no signs as of late last week that a decision in the U.S. T-101 route case was imminent, although it has been five months since the Civil Aeronautics Board gave assurances that it would act with expedition on the portion of the Trans-Pacific Route Case. Issue of whether Pan American World Airways or South Pacific Airlines, which owns T-101 from Honolulu, should operate the T-101-U.S. extended route has been in question for almost five years. During most of that time, the jointly-owned French carrier T-101 has served the route on a nonstop basis.

► Despite their welcome political rift, Russia and Communist China this month signed an air freight and postal services agreement which the parties said "is expected to increase shipments on the national respective airlines."

► New low fares were introduced last week on the Boston-New York-Washington route by Eastern Air Lines and Northeast Airlines after the CAB discounted complaints filed by each carrier against the other. Northeast alleged that Eastern's fares are "extortion" rates, and Eastern's complaint alleged that Northeast's rates were not reasonably related to costs. Eastern said it will apply to off peak Air Shuttle flights and use \$5 less than standard Air Shuttle rates, or \$10 between New York and Boston and \$12.00 between New York and Washington. Northeast's standard, non-revolution fares are now \$9.52 between Boston and New York, \$11.45 between New York and Washington.

► Shannon Free Airport Development Co. executives are working on a plan to service pure jet cargo shipments, such as the Douglas DC-9F, by making Shannon a cargo live/invite airport for various market countries. Offsets for such service will be of value in view of insurance costs levied by jet freighters, along with duty and customs advantages offered in the free airport zone.

► Finnair is looking up the supply interest in Kac/Mc, privately-owned Finnish airline operating charter between Finland and southern Europe and a limited domestic service as Finland. The airline's recent order for six Conquest Super B transports powered with Pratt & Whitney JT8D-1 turbofan engines. Finnair presently operates four Mark I Conquests. At the time of the new order, industry sources told Finnair was considering increasing its charter activity and to request a larger jet fleet.

► Aeroflot expects to increase traffic to "about 35 million passengers" in 1983, compared with 29.10 million in 1982, 21.4 million in 1981, and 16 million in 1980. The Soviet carrier's 1983 target indicates a direct rise of traffic growth to 1982, which necessitates land and personnel factor were found necessary to keep aircraft reasonably filled.

► Federal agencies concerned with inspection and clearance of air traffic and cargo now will join and for the space occupied at international airports. Budget Bureau has ordered these agencies that show the such needs will be included as their Fiscal 1984 budgetary Information and Administration Service, Public Health Service, Bureau of Customs and the Food and Animal Quarantine Service. In the past, airports have borne the costs of the space used by these governmental agencies.

► Delta Air Lines last week purchased two additional Douglas DC9-30 turbofan transports at a cost of \$11 million, bringing its DC9 fleet up to a total of 10. Two of the original eight DC9s have been converted to turboprop planes, using the Pratt & Whitney JT1D-10A1 turbofan engines. Conversion of the remaining six DC9s will begin in May, 1983, and be completed in October.

SHORTLINES

► Aeroflot's twin-engine An-24 transport and twin turboprop Tu-134 aircraft will be placed in regular service on about 50 Soviet routes in 1983. Both planes began scheduled passenger service in November. With the medium-range Tu-134s and An-24s available, Aeroflot expects to carry about 71% of its passengers in turbine-powered transports in 1983. It says "international transport will serve only residents of little towns and distant regions."

► British Aircraft Corp. will equip passenger cabins of its BAC 111 jet transport with a new type of electroluminescent lighting developed by the Sylvania Corp. of California. The new lights, previously used only for cockpit panel lighting, provide a uniform surface of light.

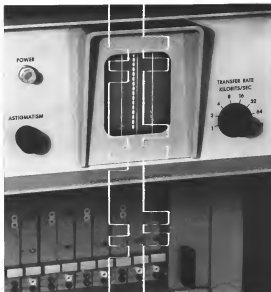
► Federal Aviation Agency has withdrawn proposed rules that would have required high performance aircraft in the 6,000- to 17,500 lb class to meet transport smoothness standards. Because of comments received from the aviation industry, FAA concluded that the proposed rule making included standards that were unnecessarily restrictive.

► General Dynamics/Convair has been awarded a National Aeronautics and Space Administration contract to study cargo, a problem involved in the development of a supersonic transport aircraft. Study will seek methods to correct or adjust the tendency of cargo to creep or elongate wings subjected to certain combinations of stress and high temperatures.

► International Civil Aviation Organization has assigned two teams of core construction and an traffic control experts to Africa and the Middle East to recommend and assist in improvement of current navigational facilities in those areas and prepare reports for governmental guidelines in long-term handling of systems.

► Japan Air Lines will increase trans-Pacific schedules to 11 round-trip flights per week beginning next spring. Six of the flights will operate to Tokyo from Los Angeles, four from San Francisco and one from Honolulu.

► Mid-air collisions involving United Air Lines and TWA over New York City on Dec. 15, 1982, has resulted in 41 employees being assigned to the aircraft and the Federal government, including more than 380 miles.



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You are looking at the newest PCM recorder designed to meet IRIG standards. The CP-200. This is not an adaptation of an FM or analog system. It's a pure PCM machine, especially designed to operate at 1000 bits (Maximum transfer rate: 120 Kilobits per second.) The CP-200 offers you this—and many other outstanding features. It has seven speeds, each electronically switchable from the front panel. It has a pulse position monitor and time



correction circuits to let you correct shift errors caused by slow and gap writer. It has modular construction, plug-in amplifiers and heads. And it bears the Amper name—your assurance of reliable, superior performance. For more details on the CP-200 write the only company providing recorders, tape and memory devices for every application. Amper Corporation, 934 Charter St., Redwood City, Calif. Worldwide sales and service.





Why Douglas took its DC-8 through the sound barrier

Breaking the sound barrier subjects a giant jet to conditions more severe than any it will meet in normal flight. No other jetliner had done it before the DC-8 test... or has done it since.

But Douglas wanted to make sure that the DC-8 had the extra dependability characteristic of all Douglas transports... quality that would safely see it through emergency over-speed situations.

A design philosophy which always provides an extra margin is why Douglas transports perform so well when the going gets rough. For example, here are a few important features that only the DC-8 and DC-8F, among all jet transports, possess:

- Automatic paralleling electrical systems... if one fails, the other takes over.
- Mechanical or cable engine and fuel controls... require no electrical or other sources of power.
- In flight engine reversal capability at all altitudes... allows rapid deceleration for landings or when meeting turbulence.
- Wings joined at the center... not at sides of fuselage where the heaviest load concentrations occur.
- Rudder-pedal steering on runways... gives better ground control at all speeds and allows control at minimum speeds.

The above are only a sampling of Douglas exclusives. There are many more, not visible to the naked eye, but of vital importance when an extra margin of durability, dependability or performance is needed.

DOUGLAS BUILDS GREAT TRANSPORTS

DOUGLAS
AIRCRAFT DIVISION



TURBINE-POWERED BELL UH-1A, carries a Visual CH-21 medium rotor troop carrier helicopter during a mission in South Vietnam. UH-1As have also worked in rescue vehicles. Note U. S. coppers has been rescued, but "U. S. Army" and small number counts.



ROCKETS FIRED BY A UH-1A impact on a target in South Vietnam, above right. Ammunition generally is low-lighted to conserve about 500 ft. ahead of the helicopter. Grenades and napalm also have been dropped from helicopters during some engagements.

Armed Helicopters Escort U.S. Troop, Cargo Aircraft in Vietnam Guerrilla War

By ERIC J. BELTON

Tactical employment of armed helicopters against ground personnel is being studied under field conditions for the first time by U. S. Army personnel in South Vietnam.

About 11,000 soldiers, personnel are providing technical training and aid to the Vietnamese, including arms and training in their use, transportation of men and supplies and construction of wounded (AW No. 12, p. 92).

Only three airports are available in the country, making transportation is poor and the majority of movements, including supplies made on Viet Cong guerrilla forces using paratroopers from fixed-wing aircraft and ground troops from helicopters, are conducted by air.

Earlier helicopter support suffered from casualties from bad weather, guerrilla forces, which the U. S. Army is countering by providing armed escort helicopters which are triggered into action whenever U. S. troop-carrying helicopters are lost upon initial Army risk to provide safe support but, from the Bell UH-1A-equipped Army Troop



TIGHT FORMATION IS HELD by low-flying UH-1As during escort missions for troop-carrying CH-21s, and others.



UH-1A FIRES A BURST of M-16 machine gun fire while flying at low altitude. Photo was not identified as being an actual combat scene and strictly record tracks in the test indicates that it may have been a practice exercise. There also is a possibility that it may have been exploding fire into a suspect area (see a post).

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- Anaconda is an approved source of TFE hose for engine and airframe contractors and subcontractors.
- Anaconda offers technical services to NARA, Air Force, Navy, and prime and subcontractors in missile and aircraft work.

We furnish TFE hose for hydraulic, fuel and pressure lines, especially where corrosion is resistant. The Teflon core, covered with stainless steel wire braid, conveys fluids efficiently at temperatures from -65° F to 450° F. Sizes range from .4 through -30.

For additional information on TFE hose, or metal hose for aerospace requirements, write Anaconda Metal Hose Division, Anaconda American Brass Company, Waterbury 30, Conn. In Canada: Anaconda American Brass Ltd., Montreal 2, Quebec.

FORBES & WATKINS

Circle

ANACONDA
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GENERAL ELECTRIC RAM-7 grenade launcher mounted on Bell UH-1A helicopter was successfully demonstrated recently by Defense Dept. officials at an Army Materiel Command review at Ft. Rucker, N. C. Device, which loads 60mm grenades, was designed by Springfield Armory, an Army Weapons Command facility, and developed by Ford Motor Co.'s Special Military Vehicle Operations under subcontract to GE's Mobile Production Center in Bellingham, Vt. GE makes turret, feed mechanism and other items; this assembly the complete weapon for Army. Helicopter subcontractor is South Vietnam Lighting, Inc. (emphasis added for this type of weapon. It is designed for use against sources of enemy ground fire directed at helicopters and against tanks and other light military vehicles.

port. Tethered Tassaparc Helicopter Command, transferred from Glenn and armed with field-approved air defense guns and rocket pods.

Subcontractors that claim clients are to be impressed soon with introduction of Bell UH-1B helicopters fitted with specially designed flow-gas (free gas) on each side) for engine maintenance directed by internal tracking system. This results a considerable increase in fuel power capability and improved crew safety.

Current model UH-1A which is improved greatly concerning a sheet of Plexiglas, adjustable vertically in a frame mounted from the cabin roof is fixed to the pilot. Helicopters are mounted on the Plexiglas. Each pilot reflects the sight by taking his machine up for a positive action, noting the air port of weapons on the ground in water and marking a "headlight" alignment with the helicopter. The helicopter would be used with great success. Guns are former tank weapons, loaded to the helicopter's sled gun. Crews generally sit upon hollow-pod "Belt" seats for personal protection, although plastic and aluminum lightweight "tip-off" seats are being evaluated at Vietnam. Army relies on tipping the penetrating slug head-on to lessen its penetration capability.

Tethered-powered UH-1As, undergoing their first combat experience, have shown considerable aggressiveness and reliability in the field. They operate as

dependently for data and tactics from base facilities when assigned to forward ground units, with ports and fuel being supplied to them. Maintenance, including engine changes, is generally performed by crews stationed under trees and with maintenance center facilities. Utilization is generally limited only by logistical support.

In addition to a fixed rocket, mounted UH-1As also provide troop-carrying, reconnaissance and gun-firing mission during post-processed Visual CH-119s.



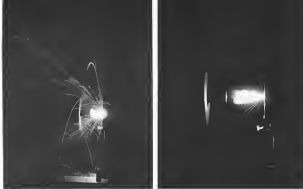
MACHINE GUN, fired from a tank and gun target to a UH-1A, is loaded prior to use. Note vertical gun-charging rod in head unit's right arm.

and Slavic, UH-1A Army and Marine helicopters. Medical evacuation is also handled. In one action mission after dark, a UH-1A lifted 19 wounded and in three consecutive while under anti-aircraft gunfire fire. It then went on to fly approximately seven hours that night to transport 35 wounded Viet namese out of North Viet. Another crew had to wait up to 10 hours in rice paddies to deliver or pickup troops—a pilot of an armed UH-1A, whose relief post had been hit by ground fire, found the fire by dashing his helicopter in a cornfield patch, as water over the ditches.

One UH-1A, attacked to a medical evacuation unit, flew approximately 150 in one month.

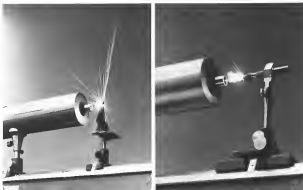
Series of combat flying indicates some needed improvements. Tail boom skins have cracked, for example, due to stresses imposed by numerous sharp cornered sections when flying at 130-110 ft. The manual often is based on the battle zone and sharp corners are common to avoid enemy ground fire or to threat between trees in tropical-forest flying to avoid detection and present a massive target to the enemy.

UH-1A rotor-blade braded hoses, each construction is standing up well under ground fire-drops estimated at 4500-lb. have completely penetrated these members at an angle without being noticed by the pilot until after landing.



Laser Bores Holes In Tough Metals

Effect of a laser bore in various high strength materials is demonstrated by Hughes Aircraft Corp. under laboratory conditions. The Hughes Model N400 high energy laser bore represents a 10-in. dia. bore in a sheet of AHS-304 stainless steel sheet (upper left). Laser operating at an output of 10 pulses, with an input of 10-000 pulses at 10 in. generated temperatures of 4100°. Similar experiment is carried out with sodium (upper right). A 10-in. dia. hole is bored through titanium (lower left), in 1/800th of a sec. at temperatures of 10-700°. Two cast refractory diamonds are cut in half in less than a millisecond (lower right).



AVIONICS



MICROBRITANNIS DIGITAL COMPUTER, left, constructed largely of semiconductor microcircuits, weighs less than 27 lb., occupies 0.2 cu. ft. volume including input-output and digital-to-analog converter. Computer was developed by Univac Division of Sperry Rand Corp. Facilitator representative gives machine continuously high speed. Module containing 193 semiconductor microcircuits (right) is one of those that make up arithmetic unit. Semiconductor microcircuits board a visible in view shown.

Microcircuit Use Slashes Computer Size

By Philip J. Klein

Operational microcircuit-based digital computer with capacity sufficient for ballistic missile guidance, which weighs less than 17 lb. and occupies a volume less than 0.2 cu. ft., including input-output and digital-to-analog converter circuits, has been developed by the Univac Division of Sperry Rand Corp.

The Microbrannis computer, under machine of its capacity not reported, is constructed largely of semiconductor microcircuits. It uses a magnetic thin-film memory which can be programmed electronically with non-destructive read-out of stored data.

Feasibility Model

Feasibility model, designed and built with computer and Air Force Systems Command, Wash., was demonstrated last week to government and industry representatives at the company's plant in St. Paul.

Major size and weight reduction in missile equipment would result in higher manufacturing cost. For this reason, Univac has placed heavy emphasis on using conversion techniques which lend themselves to batch processes and automation, according to Sidney McDonough, head of Univac's microcircuit department.

Comparison cited by McDonough suggests that this object's has been achieved. The new Microbrannis computer is only 1/8 the weight and 1/4 the size of a professor computer with com-

parable capacity which Univac built in 1953. It is built on the basis of the accuracy of ADD. The latter employed mechanical construction with conventional remote components and transistors. The new Microbrannis computer is expected to cost only one quarter as much as the larger, heavier machine, McDonough says. Estimated cost of the new computer is equivalent of a dozen or more in order \$100,000.

Univac also placed considerable emphasis on a modular design which would provide efficient disposition of internal heat without the need to use internal liquid or forced air cooling. In the new design, the hottest point inside the computer (semiconductor junctions) has a temperature which is only 8°C above that of the external computer case, McDonough says. Based on this assumption, microcircuit.

The computer is designed for operation over the ambient temperature range of -55°C to 125°C.

Computer Details

Because semiconductor microcircuits available at the time the machine was designed was relatively slow speed, Univac designed the computer for parallel processing, or simultaneous computation speed. The feasibility model uses 16-bit word length for instructions. For the operand the word length can be 16 or 32 bits with the length determined by the user-selectable precision chosen and controlled by the computer program.

Here are the computer features for

as different arithmetic operations:

- 16-bit add/subtract, 8 microsec.
- 32-bit add/subtract, 12 microsec.
- 32-bit product, 29.50 microsec.
- 16-bit quotient, 77 microsec.
- 16-bit sq. root, 17 microsec.
- Reciprocal add, 12 microsec.

Feasibility model is designed to generate 1,095 16-bit words of storage; but only 1,024 words were installed during last week's demonstration. The memory provides high random access. Cycle time is four microseconds, but the limiting factor is the speed of previously available microcircuits rather than the thin film memory itself.

Memory Capacity

Search-and-retrieve (memory) random access was magnetic thin film and has a capacity of 310 16-bit words. Physical organization of the computer is such that it can be made into a general purpose machine for a broader range of aerospace applications by installing additional memory capacity.

The next phase of the Univac project will be to build such a computer with expanded storage capacity, using an optional word length of 34 bits while retaining the 34-bit instruction.

Back of the semiconductor microcircuits used in the feasibility computer were supplied by Texas Instruments, with the scanner obtained from Sperry Rand. A batch of Feasibility Scanner driver units are currently under life test at Univac.

The feasibility model contains a total

UNITED CONTROL is here... with a control programmer in production to move the Navy's Polaris A-3 missile through its critical propulsion phases... and with a programming capability to assure the successful launch of any missile against a distant threat to world peace. For the Polaris A-3, United Control teamed with its subsidiary, Palomar Scientific Corporation, to design and manufacture a compact sequencing package employing various complex instruments. Despite the complicated nature of this programmer, United Control has met or exceeded the stringent design and reliability specifications characteristic of the Polaris project. □ Here, as in the hundreds of control systems made by United Control, reliability is the key. For aid in solving the many intricacies of flight and propulsion, environmental and temperature controls, or sophisticated accessory systems and components, call United Control Corporation: serving the aerospace industry... **where reliability counts!**



UNITED CONTROL CORPORATION Overlake Industrial Park, Redmond, Washington
Palomar Scientific Corporation and United Data Central-Subsidiaries

of 1,245 semiconductor microcircuits plus a total of 709 conventional components for functions where no suitable microcircuits were available. This count does not include the individual deposited magnetic dots in the thin-film memory stacks. Of the 1,245 microcircuits, 795 are used in the control computer, which supplies no conventional components, with another 348 in the memory and 207 in the input/output portion of the machine.

Previous Computer

Previous ADD computers had a total of nearly 20,000 conventional components, or roughly 15 times as many as are required in the new model because of the use of semiconductor resistance coils. (While the ADD had about 16½-watt resistors and some built-in substrates, its computation speed was much slower.)

This is expected to have a similar effect on the reliability of the new machine. If each microcircuit exhibits a mean-time-between-failure equivalent to that of three conventional resistors (based on having enough the most common type of semiconductor component), then the new machine should have a mean time-between-failure of about 15,000 hr, according to Univac calculations. There have been no failures to date in the feasibility model, but its total operating time has been relatively short. Computer tests on early data nuclei

exposed subjected to 4½ hr of vibration tests at 12g in frequencies up to 2,000 cps, have produced no failures. A group of 100 finished microcircuits have been operated in an ultraviolet test at room temperature for more than 1,000 hr without a single failure, McDonough reports.

Univac's reliability group conducts its own detailed post-mortem on any units that fail. Two semiconductor microcircuits which were "dead-on-arrival" from the supplier were discarded to determine the cause. One failure was due to a tin soldering on a connection wire which caused it to break during shipment from the supplier.

Second failure was due to what is called "purple plague"—crystallization which sometimes occurs during high-temperature bake-out tests allowing the connections wire to leak loose from its point of landing on the semiconductor crystal.

Important Lessons

Use of semiconductor microcircuits requires much closer coordination between the computer designer and the microcircuit designer than formerly was required when conventional components were used.

For example computer designers have been alerted previously to the danger whenever possible to replace transistors because of their lower cost, even when more diodes were required. But as

microcircuits, there is little if any additional cost in the substitution of transistor over diodes in most. The computer designer can think in terms of all transistor circuits with a gain in performance.

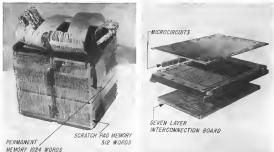
Similarly, the microcircuit designer must learn more about the requirements of the computer designer since a small change in the microcircuit design can have a large impact on computer components and cost.

Feen-out Capability

In working with Texas Instruments microcircuit designers to modify their standard designs, Univac was able to reduce the number of microcircuits required for its new computer by 15% in two of three microcircuits. For instance, counter followers were added which increased the fan-out capability from 3 to 12, according to Ted Sauer, Univac project engineer. This not only reduces the number of microcircuits which can be connected to the output of a previous stage.)

In some cases the microcircuit modifications were to increase speed or to reduce power consumption, important considerations for aerospace applications.

The feasibility model power consumption is only 3½ watts. To achieve this low figure, Univac engineers used a bare chip rate 750 hr, about 10% lower than that of the ADD machine.



MAGNETIC THINFILM MEMORY (left) is designed to provide 4,096 words of program storage, which are electrically charged and control non-destructively, plus 512 words of scratchpad storage. Only 1,024 words of program memory are installed in photo above. Microcircuit module construction details are shown (right). Long leads are cut edge of the microcircuit are bent around body, not cut short to metal discs (not shown) which are soldered to surface bonded interconnection board.

and increased the means, cycle time from three to four microseconds. Yet by more ingenious layout design, the new Macintosh computer can perform arithmetic operations at least 50% faster than the ADD machine, Samsco says.

Although magnetic thin-film micro-circuits are thought of as lower power consumers, the entire memory stack of the new computer consumes only 75% of the total required for the whole machine, McDonough says.

Central core of the computer package contains the magnetic thin-film memory. Mounted around the periphery of the enclosed memory are the three arithmetic modules and three module-shaped input/output modules, all fabricated entirely from semiconductor microcircuits. Along the cable are mounted the functions which are built from conventional components on small printed circuit boards.

Modules containing microcircuits are packaged so detach that they can

quickly be added, but there is an overall encapsulation in that individual microcircuits can, if necessary, be replaced.

Three instruments standard micro-circuits have five leads extending from the long edge on one side of the rectangular package, with another five leads extending from the opposite long edge. Unique circuit special leads with extra long leads in that those along one edge can be bent back across the body so all 10 leads protrude from one edge.

Company Process

Microcircuits are stacked by hand in a frame, separated by thin spacers which serve to transfer external heat to the external heat sink and are electrically interconnected by means of a laser-cut seven-layer printed circuit board. The latter is prepared by a Uni-Ac-derived process involving precision etching, photo-curing and other batch process techniques.

Microcircuits are lead soldered to an

interconnect circuit which in turn connects to the laser-cut interconnection board. Each soldered connection is inspected under a microscope to ensure a good joint. External connection from each module to the rest of the computer is accomplished by means of flat plastic multiconductor cabling which also is soldered.

The only quick-disconnect type circuit component incorporated in the entire computer is the one employed for connecting the computer to its external environment.

Special soldering and has been developed to facilitate removal of a defective microcircuit from the module, with no damage to the device speed of reworking.

With improved higher speed micro-circuits expected to be available in the near future, McDonough predicts that it should be possible to increase the computation speed of present design by a factor of 4-1, while doubling its already low power consumption to 75W.



SQAARTRON RADAR SIMULATION SYSTEM for RAR reception and control school field shows instructor's console in foreground. Main computing racks are at right in photo mounted and control console units are in background. Note program approach mode for GCA simulation at rear center. Each control and monitor (right) simulates specific aircraft with digital indication of speed and altitude. Monitor at top shows target positions, altitudes or collectively. Colored audio and hearing mode is provided.

Gatwick, RAF Will Use Radar Simulators

By Herbert J. Coleman

London—Falk transmissal radar simulator system developed here in Solihull, Electronic Group Ltd. for use by Royal Air Force and civil airports, is having its traffic controller with other service men at London (Gatwick) Airport tomorrow and at with the Gatwick Airport radar simulator.

Since that, the SQAARTRON will be installed in the RAF at its Control Navigation and Control School, at RAF Wycombe Station, early in December.

Both civil and military radar simulators. • **Commanded Aerial Detection Finding (CADAF)** with sequences from radar transmitters on both VHF and UHF frequencies is added by introduction of the range of confusion. Radar return is aircraft in aircraft and target shorter and longer.

• **Surveillance Radar (SQR)** simulated in a Coaxial "V" search order from aircraft in surveillance and can be controllable in rapid heading attitude. • **Secondary radar responses**, simulated according to work, scaled by the

"relief" and display operator, with 100% Am. two of the responses can be perfect up to a Standard VHF frequency. Cables SLA-1C processes approach radar to allow two final controllers. In handle two aircraft on the glide path simultaneously.

Equipment consists of two 6 ft rack, includes housing power supplies and computing elements, chief instructor's console in, control control units and four pilot monitor units. Visual control units can be selected for speed, heading and altitude. Pilot's

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away, remote control, self-sealing, miniature, SAF-LOC and many other types.

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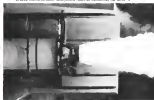
When you see to take in a sales engineer about your requirements? ☐ Yes ☐ No



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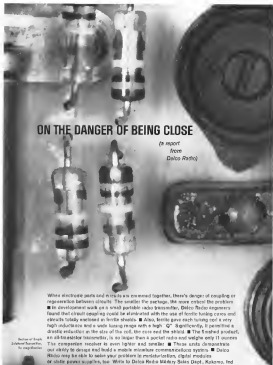
The products and production facilities pictured here prove Rohr's capability in the field of fabricating complex space flight structures. From ground support equipment to propulsion hardware to satellite components, the capability is here. A unique combination of men, imagination and modern machines solving serious problems in manufacturing methods and materials. Address specific questions to Marketing Manager, Department 145, Rohr Corporation, Chula Vista, California.



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Advanced bonded honeycomb structures



(a report
from
Dallas, Texas)

When electronic parts are finally assembled together, there's the danger of coupling or resonance between circuits. The smaller the package, the more acute the problem. ■ In development work on a small portable radio transmitter, Delta Radio engineers found that circuit coupling could be eliminated with the use of ferrite tuning cores and ferrite beads. The cores are small, cylindrical, and have a high permeability, which has high inductance and a wide tuning range with a high Q. ■ Significantly, it permits a drastic reduction in the size of the coil, the core and the shield. ■ The finished product is an all-ferrite radio transmitter, is no larger than a pocket radio and weighs only 11 ounces. The complete receiver is even lighter and smaller. ■ These units demonstrate an ability to design and build a more miniature communications system. ■ Delta Radio is a division of Motorola, Inc., 1300 E. Chicago Ave., Schaumburg, Ill. 60196. Motorola is a Division of Motorola Inc., 1300 E. Chicago Ave., Schaumburg, Ill. 60196. Motorola is a Division of Motorola Inc., 1300 E. Chicago Ave., Schaumburg, Ill. 60196.

**DELCO
RADIO**

Director of
General Medicine
Huddersfield, 1900-1902

monitor unit is a means of estimating position from the radar by range and bearing.

- **Lower suspension**, amount of control wires and below 5,000 ft, in which wires still follow rules of the air, but the wires are such as finding a forecasting decision center and finding and avoidable.

Selecting this is developing a video way for use with ATC radar display systems. Resolution is on the order of a thousandth part of the circumference to be displayed (this implies a line thickness of 200 μ d in a range of 100 naut mi).

Leaves die on a record 100 id., or 17% of the natural grass whodunnit in the greater. Scientists also say that despite extraordinary rains on coasts all 100 ft is possible so that vast dead ranges can be seen if someone. System used a moving oil slicks on the water level, sometimes back.

Video map new urban development in Scotland's production shot over Harborough is produced on London (Hertfordshire) Airport, the main international airport and departure point, and includes video presentation of the new boundaries along with the Harborough runway layout.

These units, or variations on them, will be used when Ministry of Transport establishes its new joint authority at traffic control headquarters and regional organization.

New headquarters will be headed by Air Vice Marshal Sir Lawrence Sinclair, who has been appointed by Minister of Aviation Julian Gough as first controller of the National Air Traffic Control Service (NATS).

Signs of the Times—Microelectronic engineering, dominant but now threatened by Spacelab Electronic Advances, Inc., one of the nation's largest producers of conventional computers. The action follows on the heels of the announcement that Corning Glass Works, another major com-

Under the United Kingdom concept of virginity usage, the space will be divided vertically into three trays.

• Upper airways, above 25,000 ft., will consist of a single entry within which oxygen control system will serve all aircraft.

• **Lower Research Swagway Available—**Learn for Aerospace Weapons: is the title of a 48-page report prepared by Air Force's Aeronautical Sciences Division and now available for \$8.25 from the Office of Technical Services, Con-

FILTER CENTER

• **Soviets Propose Gaseous Wave Test:** Possibility of measuring low-frequency gravitational waves by means of a Michelson-type interferometer with one arm

perpendicular and the other parallel to the direction of wave propagation, in which waves would cause periodic shift of interatomic bonds, has been sug-

gested by Soviet scientists. All optical paths in the retransformer would have to be in a vacuum. Several teeth drivers would have to be used and their main

arrangements correlated because the direction and frequency of gravitational events is unknown according to M. Ya. Gombarskaya and V. I. Pukhovskiy.

• **Saga of the Tunes—Microelectronic**

engineering department has been awarded by Spangue Electric, North Adams, Mass., one of the nation's largest producers of convolutional couplers.

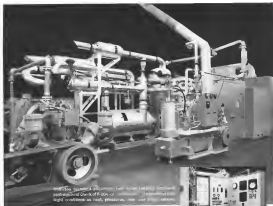
state. The action follows on the heels of the announcement that Corning Glass Works, another major component supplier, has requested a rebate.

will intent" in the Signature Corp., a major supplier of semiconductor microcircuits. The five-man Signature Board will be expanded to include three direc-

• **Lower Reservoir Swagway Available**—
 Lower for Adaptive Weirway, *etc.*

The title of a 48-pag. report prepared by Air Force's Aeronautical Sciences Division and was available for \$1.75 from the Office of Technical Services, Cam-

AVIATION SPACE and SPACE TECHNOLOGY December 24, 1949 51



Flight lab for the F-104 air-conditioning system

The Lockheed F-104 Starfighter's air-conditioning and pressurization system "Ties" within this pneumatic test stand, designed and built by Hamilton Standard.

Two electrically driven 150-hp reciprocating compressors in the test stand simulate engine bleed air. This air, cooled through aftercooler-water separator, surge tank, and furnace, is then supplied to the turbine fan and the test chamber. A 150-hp turbine compressor simulates ram air. Capacity: bleed air, 55 lb/min at 200 psig, 480°F; ram air, 130 lb/min at 6 psig, 600°F; pressure, up to 1 lb/in at 150 psig.

Building test stands of this type demands a

high degree of technical competence in systems engineering, electrical circuitry, pneumatics, hydraulics, electronics, and packaging. At Hamilton Standard, these capabilities are integrated with quality manufacturing.

Hamilton Standard has produced test stands for environment conditioning equipment, jet engine fuel controls, propellers, and a broad range of related aerospace systems and components. For the solution to your aircraft and missile test equipment problems, write: Sales Manager, Ground Support Equipment, Hamilton Standard Division of United Aircraft Corporation, Windsor Locks, Connecticut.

Hamilton Standard DIVISION OF UNITED AIRCRAFT CORPORATION

AIRCRAFT & INDUSTRIAL ENGINE CONTROLS • EQUIPMENT CONDITIONING SYSTEMS • GROUND SUPPORT EQUIPMENT • TURBINE STRESSOR • SOLAR POWER GENERATORS • STATIC POWER SYSTEMS • AUTOMATIC STABILIZATION SYSTEMS • BACKGROUND BEAM MACHINES • PROPELLERS

for the IMCC and conduct area and maintenance simulation exercises between IMCC and Cape Canaveral and the mission control center.

It also will furnish aircraft communications directly between IMCC and simulate area's type 2 simulated remote site in IMCC will support the worldwide network in a training or simulation exercise.

The communications system is expected to handle voice, telemetry and digital data. During mission periods IMCC will control all communications. In non-mission periods, the control of COMS communications will be exercised in Goddard Space Flight Center in Greenbelt, Md.

Digital Systems

Digital systems to be employed will include digital, low-speed serial bit stream, high-speed serial bit stream and telemetry composite bandwidth data links. The IMCC digital communications processing system will accept data words in a frame format at speeds from 45 bit/sec to 7,160 bit/sec and up to bit rates compatible with video-bandwidth links. The processing system will upgrade the signal, detect and correct transmission errors, resequenced and retransmit data to proper parties in closed format and speed.

Traffic storage capacity is also planned.

In non-mission periods, telemetry will be the normal communications mode with other modes available for checkout and simulation. In mission periods, digital communications will consist of telemetry traffic such as heading data, telemetry data, message text and will have compressed traffic, low-speed data, high-speed data and telemetry data points.

Video Circuits

Two incoming video circuits will carry display information consisting of video from the launch area with search control camera selected and video transmitted from the Apollo spacecraft through the Goldstone site of the Deep Space Instrumentation Facility.

Simulation, checkout and training system (SCATS) will support checkout of IMCC systems and the training of operational personnel under realistic mission circumstances according to NASA's Space Flight Center plan. SCATS is contained in a series of implementing system checkout for operational readiness checkout and training of flight controller personnel.

The implementation checkout will require combining checkout and debugging of the operational and simulation systems. For operational readiness checkout, a comprehensive test program will assess that all parts of IMCC, in

cluding display systems, dynamic testing and data review, is correct before data activity, simulation training activities and voice systems are exercised.

Display system will provide facilities for displaying both computer-derived and video-derived data obtained from ground support elements and the spacecraft. It will include display control, reference and position equipment, command display drivers in the mission control rooms and adjacent staff support rooms and the various video interfaces.

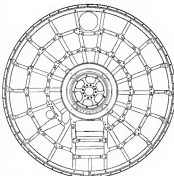
The display system will be capable of handling a number of formats, alphanumeric, X-Y plots, video, in-

level indicators and vector type information, among others.

It will support mission control, decision making and mission and flight display. It will provide for understanding, interpretation and file systems performance, vehicle system performance and ground system status.

Information derived in the form of speech or telemetry data, ground-based data or manual inputs from the flight controller at mission time is to be made available to the communications terminal equipment at the IMCC to be received in the computer complex,

WHO BUILT THE TIROS STRUCTURES?



RCA developed the NASA weather satellite . . . Lovell built the complex 18-sided structure to carry its active components. Lovell specialists in the precision fabrication of sheet metal structures for missiles and space vehicles, aircraft and ground support equipment. Major contract: design, develop and produce the Tiros structure. Lovell's quality controlled services: Engineering Production Planning / Sheet Metal Forming / Welding / Machining / Metal Finishing.

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..... NEWS OF DEFENSE TECHNOLOGIES

RE-ENTRY

One hundred and ten successful re-entries into the earth's atmosphere from ballistic, space-probe, and orbital trajectories—both heat sink and ablative vehicles of various configurations, weighing from 18 to more than 5000 pounds—this is the record achieved by General Electric during the past four years.

From the first flight test of the G-2 Mark 2 nose cone on June 15, 1959, through the first successful recovery of a satellite re-entry vehicle on August 18, 1960, to the successful intercept of Nike-Bee Target Vehicle on July 19, 1964, General Electric has pioneered in advancing technology for the development of ballistic re-entry vehicles, space probes, and recovery capsules. More than 350 vehicles have been produced and delivered under U.S. Air Force and NASA programs, with over six tons of hardware recovered successfully from space vehicles.

Information gleaned and recovered from these vehicles has furnished invaluable data that is leading to the advanced re-entry concepts needed for more sophisticated weapons systems, exploration of outer space, and entry into other planetary atmospheres.

As payload weights increase and space missions become still more complex, General Electric will meet these challenges with a broad re-entry capability and demonstrated reliability gained from repeated successful performance.



G-2 MARK 2 is the largest re-entry vehicle ever flown at a 300,000-foot altitude inside of two hours' ground atmosphere as they range widely around the U.S. Air Force's powerful Titan II missile.



HEAT PROTECTIVE (Recovery Vehicle) has achieved 1120 miles into space in vehicle collection data for the H-2A. It was the first vehicle equipped with a disintegrant heat shield to achieve successful re-entry.



G-2 MARK 2 re-entry vehicle holds the world's distance record for its flight in excess of 1000 miles. It was the first to be used by the U.S. Air Force's ATLAS and Titan II missile. It was a spin-off from the AFRL.



HEAT PROTECTIVE (Recovery Vehicle) was the first re-entry vehicle to be launched with a high percentage of vehicle collected by the United States. It was developed by G-2 under the Air Force's satellite research program.



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Progress Is Our Most Important Product

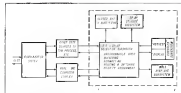
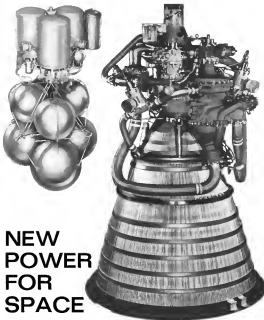
GENERAL  ELECTRIC

AEROSPACE AND DEFENSE GROUP

NEW POWER FOR SPACE

These new powerplants are an RL10 liquid-hydrogen rocket engine for propulsion in space, and a model of a fuel cell to provide electricity in manned lunar vehicles. Their mission: Power for space. Their designer and builder: Pratt & Whitney Aircraft for the National Aeronautics and Space Administration.

Pratt & Whitney Aircraft
U
A
a division of the General Electric Company



SUBC. DIAGRAM of the Integrated Mission Control Center display system (within dashed line) can accept input from the IMCC's real-time computer complex, television, telemetry, communications, data storage and other sources.

the display system or both. These data will be real-time information related to the status and performance of the spacecraft and ground stations.

Display system, according to NASA instructions, is to accept mission data from communications, or separately, from the computer complex, the communications system, data storage systems, local telemetry system, TV stations and manual inputs from the operators personnel.

Emphasis will be on display devices capable of handling several formats to maximize the number of devices and maximize flexibility.

Display Devices

Display devices are to be capable of presenting different quantities in identical or different formats simultaneously on the same display, possibly superimposed on one another. One example cited in NASA's work statement on IMCC, is the display of a computed orbital track superimposed on the closed nominal orbital track, all of which is superimposed on a reference world map. Latitude and longitude, indicated along numerically, might appear elsewhere on the display.

Operating in variable modes, the display system is intended to have programmed, requested and forced modes of display. Forced mode refers to that situation in which operators personnel are alerted to data, not to display, which are approaching or exceeding critical limits.

The operator will be able to override the forced display to present other critical displays.

Data display system will be divided into four functional areas or subsystems necessary to drive and control display equipment. The four subsystems are:

• **Console and wall display**—Terminal of display information. SCATS displays devices associated with mission control rooms and technical support consoles

and wall displays. The control for the display regulation of each console will be exercised through a display request section of the console.

• **Data display selection**—Through this key substation, data flow intended for display and operation of the system is controlled. It is to operate in an on display control point to provide buffering, signal conditioning, format conversion, switching between data sources and display system, maximum of display capability and priority of image input. It is programmable for automatic formatting and script name requests and has override capability for forcing display under priority emergency conditions.

• **Display storage**—Two storage devices, one possible a magnetic storage element and the other a photo scan system use cookies card file, will store display storage capacity. The former would store tabulations of non-real-time data available on a pre-program basis or could store fixed formats, footprints or outlines for some of the display presentation while the latter would allow accessible storage of viewpoint, charts, maps, text footnotes or pertinent data for on-line support.

• **Characterized information**—Image information will be related to the information to console or wall-mounted television monitor screens. Special TV effects, like light screen, selective blocking of portions of the screen and blocking of data are planned. High-resolution TV may be projected onto large display screens.

Instrumentation System

Operational instrumentation system (OIS) will support the mission control rooms in a real-time data acquisition and processing system. Between systems, the instrumentation system will employ the SCATS system in handling operational interface problems.

It will be able to participate in all

mission in a real-time data gathering facility. It can provide telemetry data extended to communications line bandwidth.

During lunar missions, OIS will supply data necessary to determine the status of the lunar communications equipment aboard the orbiting spacecraft. It is to have a large omnidirectional antenna, an RT scanner system, telemetry, an RT data link and a communications interface network. It will provide:

• **Lower communications checkout**, supplying data obtained in real time from the orbiting spacecraft to the IMCC computers for processing and display at the mission control room consoles.

• **Mission participation** can be converted to IMCC computer and mission control room so that it can function as a real-time operational interface when a spacecraft is in range. Outputs from its tracking telemetry and uplink station would be fed through the communications interface and the IMCC operational computer much as data are transferred from remote GDS sites. The operational instrumentation system would offer a high quantity of such data.

• **SCATS interface**—OIS can supply data to activate SCATS mission interface console.

• **Communications interface**—Communications interface will connect the high-rate (128,000 bps) OIS to the low-rate (2,000 bps) IMCC communications interface.

Computer Complex

Computer complex, for which IBM has responsibility, will be an integral part of IMCC and will support mission and real-time data processing of manned space flight programs.

Flight controllers are expected to rely heavily on the real-time computer complex to supply information and coordination in the event of short contingencies or otherwise manned space flight mission. The computer complex must keep controllers informed of all information needed to make critical decisions.

This task will require monitoring of spacecraft trajectory on the basis of tracking data supplied to it and processing data from the spacecraft systems to determine precisely and display mission status.

If a primary mission cannot safely be accomplished, the alternate program will be required of reprogramming a suitable short trajectory in the event an abort becomes necessary during any phase of the mission.

A manual control will be available to controllers for complete or reduction of any of the largest sections of the computer program.

Lightning Radiation May Spotlight Storms for Weather Spacecraft

Detection of electromagnetic energy induced by lightning may provide future weather spacecraft, such as NuBus with a capability for spotting thunder storms over India from Tinsu mountain in cloud layers between the satellite and the storm.

International Business Machines Corp.'s Space Guidance Center at Dayton, N.Y., is conducting a \$150,000 study for the Weather Bureau on the parameters of a detection system for use on weather satellites. Objectives of the HF studies (high frequency atmospheric studies) are to determine the characteristics of energy induced by lightning and ascertain the signal-to-noise ratio that might be expected of satellite altitudes.

Reynold Hallgren and R. R. MacDonald, IBM atmospheric physicist, are in charge of the project. The method they use to determine the strength of lightning-generated high frequency signals is relatively simple.

Weather stations at the Buessow Coast Airport near Chicago detect thunderstorms in the area with radar and north Hallgren and MacDonald, who form one of two sensors set of the frequency between 100 mc and 600 mc.

The signals are displayed on an oscilloscope and recorded on 35-mm film. Since distances from the antennas to the lightning flashes are known through either radar or visual observations, it is

possible to plot amplitudes against distances traveled by signals and thus determine signal strength.

Some ground-based storm networks in the 10 to 100 mc portion of the lightning signal spectrum are now in use to detect and track storms. This is the maximum energy portion of a lightning flash, but low frequency signals cannot penetrate the ionosphere, so are not atmospheric data useful for detection of low frequency lightning pulses would be taken in a weather satellite.

Another attractive feature of high frequency detection system is the relatively small antenna required—50 ft or less in length—in a satellite versus systems on the ground.

Stanley D. Soles, research physicist at the Weather Bureau satellite center, Suitland, Md., indicated that the next step in studies development can be flights in aircraft and balloons.

"If the data in the current study is encouraging, it might be possible to proceed with balloonborne studies in aircraft and balloons in six months to a year," he said.

Since development of an HF storm light system could be developed largely from off the shelf components, Soles is hopeful that the IBM will follow on studies indicate it would be feasible to include it as one of the four NuBus research and development flights scheduled to begin in the fall of 1965.

CAREER OPPORTUNITIES IN THE 5 AREAS OF DALMO VICTOR SYSTEM CAPABILITIES

The significant development progress of the future of our missile capabilities. Dalmo Victor's contributions include close cooperation in development of career opportunities in areas of design, integration and testing.

1. AIRBORNE ANTENNAE Important role in the successful operation of both land and strategic weapons systems. Current high performance antenna packages for aircraft and tanks, launch vehicles, ground tracking, the aircraft and a broad range of other projects.

2. AIRSPACE TRACKING SYSTEMS Weather ground-based command and control stations provide tracking and control systems for various weapons. Deep space capabilities. Dalmo Victor has the experience of providing complete systems, from basic design to erection.

3. MICROWAVE SYSTEMS Dalmo Victor has been deeply involved in microwave systems for many years. Long-range systems for defense, scientific tracking, reconnaissance and electronic warfare with capabilities for satellite control and electronic countermeasures.

4. MAGNETIC SYSTEMS Another Dalmo Victor advancement area, involving such unique developments as self-inductance and uniform waveform systems, various vehicle stabilization and attitude control systems, and other systems in magnetic and in magnetic fields.

5. GROUND SUPPORT EQUIPMENT In partnership with California Technical Laboratories, another Dalmo Victor company, Dalmo Victor supplies a wide range of ground support and ground environment equipment from a highly effective combination of its civilian and military. Dalmo Victor provides important single source responsibility.

The page opposite describes one of the many Dalmo Victor's capabilities. Soles' role and experience of unusual ability are marked in further steps and other Dalmo Victor concepts. If you would like to work in this critical atmosphere and enjoy the many advantages of living in the San Francisco Peninsula area, please send a resume to Dalmo Victor. It is our most rewarding.

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DALMO VICTOR MEASURES THE "MISS" IN MISSILES How close does an attacking missile approach a target? Dalmo Victor's non-cooperative Distance Measuring System gives a continuous digital readout of the range—accurate to the foot! Typical of Dalmo Victor's microwave versatility is this company-sponsored research and development project. This DV concept uses high resolution pulse radar techniques—with both the transmitter and receiver housed in the target. Not only is this new system important for missile evaluation and testing, but its accurate range measurements can offer important advantages for satellite rendezvous, orbital docking, lunar landings and other sophisticated space operations. □ Microwave systems are another example of Dalmo Victor's project capabilities. DV is in the vanguard of the new developments in our major product areas. If you are interested in becoming a part of these challenging programs, Dalmo Victor currently is seeking applications from qualified scientists and engineers. For further information contact Director, Scientific and Engineering Personnel.

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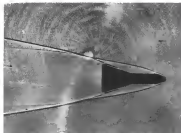


A TETRON COMPANY



Project Fire Re-entry Model Studied

Scale model of Project Fire is being tested for test in Langley Research Center's Convay Test Wind Tunnel. Tests tests in the tunnel are designed to determine static stability characteristics of the model. NASA's Project Fire is designed to study the re-entry system (AWD 37, p. 13).



Navy Tests Models in New Shock Tube

Relatively large-scale models get blown through a new two-stage shock tube at the Naval Ordnance Laboratory, White Oak, Md., at velocities of more than 10,000 fps. The model shown in the photograph was made of balsa and titanium and was fired at a velocity of Mach 15. NOL scientists said the balsa behaves better in shock waves because the driver gas is heated, thereby assisting its pressure for compression, rather than the methane in shock tubes where a chemical explosion is used as the driver gas to reach 40 temperatures and this causes the pressure of the gas, transfer from the explosion, to compress the gas and thereby makes it heavier and less efficient.

Ship Station Planned For Test of System

USNS Knapport, recently converted from a World War II Victory Class freighter to a seagoing satellite communications station will participate in testing of NASA's communications system for communications satellite (Comsat) which is scheduled for launch early next year (AW Aug. 20, p. 56).

During the test the ship will supplement land-based communications and tracking stations.

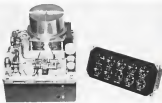
Designed and developed under the aegis of the Navy's Bureau of Ships at the Philadelphia Naval Shipyard, the vessel is officially attached to the Military Sea Transport Service (MSTS) but will be operated by the Army Satellite Communications Agency (Satcom) in conjunction with its Defense Satellite Communications Program. This program was organized for development of systems to fulfill satellite communications needs and requirements.

Major modifications of the ship include a 12-ft. pressurized volume constructed of titanium control drums, situated on the aft deckhouse, and a 140 antenna on the forecastle for Sea view telemetry and command.

Budenberg houses a 50-ft. sternmost parallel tracking and communications masts. Its latest recent developed

by General Electric Co.'s Odeton Division, permits simultaneous motion in three directions.

It can rotate in seawards while at the same time moving in elevation and rolling laterally, thus compensating for all roll, pitch and yaw of the ship and ensuring the equivalent of a stable platform.



Spaceborne Gas Chromatograph Delivered to NASA

Bendix Instruments Inc., Fullerton, Calif., has delivered a spaceborne gas chromatograph to NASA's Marshall Spaceflight Center at Huntsville to monitor closed atmosphere in a manned space vehicle. Total package which weighs 12 lb. and uses only a few watts of power consists of analyzer and pump module and helium storage tanks. Detector will automatically and continuously extract atmosphere to detect radiation and permit correction.

form. Mechanical power system employs direct drive, disc torque system, the technique of passive suspension characterizes much of the backlash that is associated with conventional gear boxes.

Communications equipment aboard the Knapport provides a two-way, radio-based, high-speed receiving data link with land-based stations, as well as a high frequency communications link to land. The direct test coordination between ship and land-based stations.

Plastic Film Designed For Comsat Erection

Plastic film, which deforms, or photoelastic, under the continued influence of heat vacuum and ultraviolet radiation, will appear to offer several promising applications in the erection of passive communications satellites and other space structures, has been developed by the Goodrich Aircraft Corp.

This would be used as an inflatable bladder for erecting wire grid structures, which would become rigidized and retain their shapes after the film had photoelastic.

Important advantage in this technique lies in the fact that the structure would not depend on gas pressure for rigidization, as did the fabric satellites, and that would not be subject to degradation by shape due to increased impact or thermal stresses.

In addition, the total surface area of the satellite would be reduced after the film photoelastic in this respect, rather than due to acceleration drag and solar radiation pressure.

HOW TO
GET TO THE
MOON

FOR A MOON VESSEL, YOU'LL NEED A MASSIVE TRUCK, A PICKUP, AND A SPORTS CAR. UTE HAS ALL THREE. NOW. OUR TRUCK: A SEGMENTED, MULTIPHASED, SOLID PROPELLANT ROCKET-BOOSTER, FOR BRUTE FORCE TO PUSH AN EIGHTY-PAYLOAD OFF THE EARTH. OUR MIDDLE-STAGE PICKUP: A SEGMENTED, FILAMENT-WOUND, SOLID PROPELLANT VEHICLE, WITH DEPENDABILITY AND EXCEPTIONAL PERFORMANCE AT ESCAPE VELOCITIES AND WITH ABOUT 20,000 MOVING PARTS LESS THAN LIQUID SECOND-STAGE ENGINE. OUR THIRD-STAGE SPORTS CAR: A HIGHLY MANEUVERABLE, STOPPABLE, STARTABLE, RADIATION-COOLED LIQUID ENGINE, FILAMENT-WOUND FOR LIGHTER WEIGHT, SIMPLE, RUGGED, IDEAL FOR SOFT LUNAR LANDING. THE SYSTEM IS RELIABLE, PRACTICAL, STATE-OF-THE-ART DEVELOPMENT AT UTC.



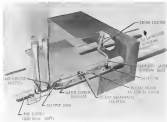
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A



NIGHT PHOTO OF CELL J-3 in operation (left) shows "motor"—acoustic-coupled particles in exhaust—propelled about 150 ft. high. Cutaway view of cell (right) indicates overall configuration during test of full-scale motor motor.



Modified Jet Cell Tests Missile Motors

By Warren C. Wetmore

Rocket Aircraft Cell J-3—a modification of a test cell formerly used for jet engines at the Air Force's Aeronautical Engineering Development Center, Tullahoma, Tenn.—is being used for testing firing of full-scale. Situation in (ICBM segment and third-stage rocket motor) and Rocket Aircraft second-stage motor.

Construction of the cell was completed by ARDC, Inc., contract sponsor of the engine, in late 1964, shortly before start of the design and the test open-house firing, which was of a Minuteman third-stage motor. Cell is designed to accommodate solid-propellant rocket developing thrusts as great as 80,000 lb. at sustained pressure altitudes of up to 331,000 ft. and temperatures as low as -120°.

The limited capability is in keeping with the cell's mission of testing rocket motors under conditions encountered during boost phase.

Scope of the tests includes grain characteristics, internal ballistics performance, base heating environment, acoustic pressure, thrust decay and operation of thrust termination and thrust vectoring systems.

Basic test cell structure is 20 ft. in diameter and 68 ft. long. Thrust and vibration generated by operating rocket motors are borne by a large steel thrust belt.

The test cell has two exhaust systems:

- Rocket exhaust system, which operates while the motor is firing. The exhaust gases from the rocket pass into a water-cooled diffuser and are discharged to the atmosphere by means of dual air systems which are 55 ft. high at the test plane. Thrust diameter of the driving nozzle is 1.5 ft. The stacks are 3 ft. in diameter and are fitted with drag-resistant nozzles having an exit-glass diameter of 10 ft. During a rocket firing, the exhaust system is cooled by water spray. Exhaust is supplied with air at a rate of 500 lb./sec. from the continuous air supply—a large electro-mechanical pump—while some of the original jet test cell. During a test, in-

stead of high pressure storage tank. For containing the system, air from both sources is introduced to approximately 500 ft. and 150 ft. for improved pump up.

• Auxiliary exhaust system, consisting of a steam-driven system and the original cell exhaust system arranged in tandem. This system is used for operation of the cell before a run and for removal of acoustical exhaust gases and leakage during a run.

In a typical run of Cell J-3, the test cell is isolated from the system by means of a 0.6-in. thick line-outlet. Nozzle discharges inserted in the diffuser (see artist's conception p. 64). The rocket motor to be tested is installed in the thrust stand and all instrumentation and fractional equipment in the motor is connected, including a circuit between a pressure transducer in the boost chamber and an explosive cord attached to the Nozzle discharges. Motors operate and vibration measurements are focused on the motor.

Cell Closed
Cell is then closed and sealed. After the instrumentation is calibrated, the cell is evacuated to 0.05 psi. The auxiliary exhaust system coupled with the steam exhaust. The instrumentation is recalibrated at the low pressure and the three-dimensional load with air calibrated by a specially adapted dual-weight system, which has an accuracy of 99.9%.

During this time, the air system on the other side of the Motor discharges are operating from the continuous air supply.

After 500 lb./sec. of air is obtained from a high pressure storage tank. For containing the system, air from both sources is introduced to approximately 500 ft. and 150 ft. for improved pump up.

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Plastic Material Catches Artillery Shells in Tests

Rocket shot traveling at more than 400 mph. at China Lake, Calif., contain layer of flexible plastic material to catch 315 mm. low-velocity shells in Army program to develop shells with improved power and more accurate and uniform firing characteristics. At left, shell is photographed a few feet of a general before impacting in the material, called EnerGel, developed by U. S. Rubber Co. At right, shell is removed undamaged from the plastic for study by engineers from Army's Ordnance Research, N. J.



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supply. About 20 sec. prior to ignition, air from the high pressure tanks is also fed into the motor, bringing the total flow rate to 1,000 lb./sec. Then the rocket motor is closed, firing the propellant and igniting the rocket motor.

Gas Exhaust

When the chamber pressure in the motor achieves a preset value, the pressure transducer triggers the explosive cord on the Motor discharges, permitting the exhaust gases to escape to the system.

Pressure in the chamber will fall about 15,000-20,000 ft. during a firing depending on the size of the motor being tested.

At harvest a trigger door on the downstream end of the diffuser is closed to seal the test cell, and the air supply to the system is shut down. The nozzle and exhaust system maintain pressure in the cell until completion of the post firing tests such as vibration of float decay and post firing vibration.

Expanded motor is removed for construction for health that might cause failure. Raw data obtained from the instrumentation, which was digitized and recorded on high-speed magnetic tape during the run or as soon as 400 char. rate, are reduced to a series of as technical Business Machines 7090 digital computer and plotted.

Designs from a test cell described in a previous issue (AEC Sept. 25, 1961 p. 227) has been changed from J-2 to J-3. Cell J-2 is known as the "China Lake" cell. The cell is known as the "China Lake" cell. The cell is known as the "China Lake" cell.

PRODUCTION BRIEFING

Maag Sealsystems, Inc., has received a \$1 million contract from General Dynamics-Fenelon for production of electrohydraulic servos for the flight control system of Navy's advanced Vought F-4 Phantom II fighter.

Control Control Corp., Redwood, Wash., has been awarded a \$27 million follow-on contract from the Boeing Co. for production of special ground-based environmental control system equipment for use in the Minuteman missile program.

General Research Center of the Southwest, Tulsa, Okla., will develop scientific experiments in area, planetary, and space exploration under a \$4.5 million National Aeronautics and Space Administration contract.

Boards Corp's El Paso-Panama Division has awarded a \$100,000 Air Force contract to develop a large-scale control system of the type which can be used in the GAM-87A Stealth missile. System is powered by the combination of a solid propellant, which is ignited when the missile is launched. Contract contains a \$100,000 option for performance of an additional system.

Quantum Research, Inc., Silver Spring, Md., has been awarded a \$200,000 Navy contract to upgrade and extend the Reliability Maturity Index System, now being used in management of the Polaris program.



Minuteman launch package



Electronic security design



SPAR sensor research



Control console assembly



Computer technology advancement



Satellite control system



Electronic circuit assembly



Control console and instrumentation



Test a simulated airframe control



Electronics capabilities - at Boeing Aero-Space Division

More than 4,000 of Boeing's Aero-Space Division's personnel are engaged in electronics research, design, manufacturing and applications activities.

Twenty-one electronics organizations provide everything from advanced research to the components and total systems required by the Division's programs. General areas of activity include communications, radar/optical systems, radars, communications, radar navigation, mission development, electrical materials and radiation-effect studies.

Currently, Aerospace Division is manufacturing the

launch control system for Minuteman, flight electronics for the N-20 Dyea Star space glider, hybrid air-outlet system interface equipment, security systems, an orbital tracker and airborne communications.

In electronics, as in all phases of systems management, emphasis on quality control and reliability engineering has contributed toward the Division's unblemished record of performance. It has also spurred the design and development of superior products, manufactured and delivered on schedule.

BOEING
AERO SPACE DIVISION

EQUIPMENT



GRACE VOYAGER/NAVY FEA scales out of 1,800-ft. strike of ground-based catapult in record Marine Corps test. One of the catapult tapes can be seen running through pulley in left foreground. Test system has another track but operational runway will not

Marines Testing 'Package Airfield' Designs

By Donald E. Pink

Philadelphia—Advanced lightweight catapult and arresting gear designs are taking shape at the Naval Air Engineering Laboratory, here as final selection tests of aircraft launch equipment for the Marine Corps' SATS (short airfield tactical support) program.

Target operational date for the program, which calls for 12 mobile "package" airfields, is June 18, but all the equipment will not become operational until late 1968.

Short-field concept involves establishing airfields on rough backbeaches in three to five days and operating them for 30 days or 1,000 sorties with conventional catapult launch support within three feet and movement.

Main components of the airfield packages will be:

- **Short-runway**—meeting for a minimum 2,000 ft. long and 60 ft. wide and five feet deep and parking area. Marking equipment, which will be erected with a plastic line, antiskid compound, will be performed for area support. The runway will consist of two reinforced aluminum plates, 2 ft. x 30 ft., with supporting cross members spaced between the plates.

- **Two portable catapults**, either the old type which uses two large nylon tapes and a slingshot effect to propel aircraft down the runway, or the cable type which uses a closed-loop cable to pull aircraft to takeoff speed. The catapult will be powered by one of two powerplants—a jet engine or two Pratt & Whitney T54-SW turboprop engines used at a total of 11,500 shp, or a cable-pulling system linked to a free turbine tested by a General Electric T9 gas turbine rated at about 16,000 lb. of thrust.

- **Two portable arresting devices**, which will use cable pods for landing hook engagement and two nylon tapes, attached by a braking device, for arrestment. Nylon tapes will be 6-10 in. wide and 4-in. thick.

- **Two runway and taxiways**, which probably will be performed after the Swedish Saabland type, consisting of upper and lower horizontal nylon tapes and a series of control system struts spaced to distribute the landing forces evenly over the wing and tail surfaces of the aircraft.

- **Portable control tower**, complete with mounted instrument and navigation landing system and portable airway and landing light system.

- **Launchable maintenance shelter**, used for crew lockings and nylon belt cutters for a tactical field depot. Other aids, peculiar to carrier-type operations, such as a main optical landing system, also will be included.

Three airfield packages, which will cost about \$1.7 million apiece, will go to each of the Marine Corps' three air wings. These will be kept in spare.

Two offices and 25 technical staff are preparing the launch and arrestment crew, will be designed SATS personnel and assigned to each portable unit. The number of the support complement will be taken from fixed bases where the equipment normally operates.

About \$70 million has been spent on research and development of operational components since the program was begun in earnest in August, 1961, a Navy spokesman said.

The short-field concept originated in basic form during World War 2, but serious consideration was not given to test until the Marines started doing heavy lifts. The limited "beach box" was tested in the late 1940s and early 1950s.

Conceptual allocation of funds for serious development of the concept, which has taken on new importance since U.S. involvement in South Vietnam and the Cuban crisis.

Program manager for the short airfield development is Lt. Col. G. C. Gresham, head of the equipment and logistics section of the aviation logistics and material branch.

Tactical assignment is the responsibility of the Air Engineering Laboratory, which is part of the Naval Air Material Center in Philadelphia. The mechanical component directly concerned with aircraft launch and recovery are developed here.

Catapults posed the biggest problem since high performance had to be achieved from designs that were light enough to be airlifted.

Developed so far will cost \$1.25 in the launch system and will provide about 10% of takeoff power. Shipboard stress catapults cost much higher prices and provide about 50% of takeoff power, but they are not compatible with mobile operations because of greater weight and bulk.

Catapult development has progressed in stages along two parallel avenues. At first, some version of the cable and rail type have been built as station devices to develop and test concepts such as clutch assemblies, control lines and attachment leads.

Chances for success have been increased to two

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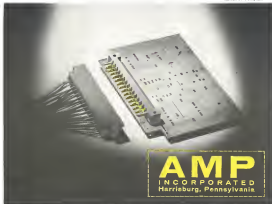
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RE-5 DEVELOPMENTAL CATAFALT, shown in final assembly stage, has Pratt & Whitney T406W turboprop engines set at each end of frame. Bulkhead then the drives are hydrodynamic clutches. Type rack and pinion gears are located in the center. The RE-5 was built in an interim design to perform the clutch assembly. RE-5 will have the most complete configuration in that of the R-5.

designs, both in the 50 million foot pound class. They are:

- RE-3, rail type, developed by E. W. Rice Co., Corvallis, Ohio
- CE-2, cable tow, developed by All American Engineering Co., Wheeling, W. Va.

Early development models had track-mounted nose wheel skids which served both to guide the aircraft down the runway and to prevent the resultant nose-up force generated when tension is applied to the towing bridle.

Track and skid skids added weight to the aircraft package, however, and extended the installation time, since it had to be anchored. Specifications were set for a trackless system. Successful tests with trackless systems of both skidless, wing drag loads and balanced skidless have been conducted at the Naval Air Test Facility in Lakehurst, N. J.

Live tests with skidless aircraft will be conducted early next month, and final sections of the catapult for the operational status is scheduled for May 1966.

RE-5 has the two engines facing each other at opposite ends of a large frame. Powerplant will be set to one side of the runway. In the center of the frame is a dual-track tie rod with special roller drive clutches on each side.

Clutches, developed by Douglas Aircraft's Marine Products Division, are driven by the working fluid between two spooler wheels. Clutch can be thrust into smooth acceleration by raising a sleeve over the preloaded spooler wheel and regulating the flow of water. One of the clutches is driven directly by an engine. The other is driven through a reverse gear, because of the reversed engine position.

Tapes from the reel are played out to large pulleys at each edge of the runway. Tape to the upper inside pulley runs in a channel under the aircraft seating. From the pulleys, the tapes are strung down the runway where they

connect with cable pendents which attach to the aircraft launch bridle.

Aircraft is attached to the bridle and then actuated with a standard center hold-back hook. Tape tension is increased and aircraft position is applied until the hold-back clutch goes full. Aircraft is then propelled by its own power with an assist from the specially rated tapes. Tapes are in slung bridle heads when the aircraft reaches the "start" position, separate the reel and aircraft is accelerated to takeoff speed.

CE-2 catapult uses a single cable loop, one portion of which runs from the aircraft bridle up the runway, around a pulley and over to the power unit, which also acts off the runway. Unit, called the LM 1500, consists of the J79 gas turbine engine which exhausts into a low air turbine. LM 1500 may be used to operate the experimental version of the RE-5 due to shortage of T4 engines.

Turbine is linked to a large capacitor, exceeding from one side of the unit. Cable is looped 24 times around the capacitor. Threaded through a hydrostatic shock compressor and then strong bridle along the runway, where it is looped through two more pulleys and back to the rear of the bridle.

In operation, the CE-2 works like a rope tow on a dry slope. As the capacitor is tensioned, a switch the cable on and off at the same speed, pulling the bridle along the runway and launching the aircraft.

Marines are striving for a launch in quarter of 90 sec., but bridle action on the development model has been slow. Small machine engine models would be used in the operational CE-2 uses catapult to return the bridle to the launch position. Rotors of tapes and cable pendents on the RE-5 are not been considered, would not cause the destructive track wear eliminated.

Aircraft gear will use water tapes attached to one of three braking devices now undergoing Navy evaluation.

• Rins-developed M30-based 1, which was a large bridle drum, similar to that on a Boeing B-57 bomber, and also contained bridle drums to stop the tape reels.

• All American M-24, motor bridle, with tape reels attached to a large paddle wheel set in a tub of water. Energy of landing force is dissipated by driving the water.

• Vortex M-21, which uses a Vortex shock with a rotating wheel attached to the tape reel and the other locked in place. Arrestment energy again is dissipated into the working fluid.

Shock-field installation requires would be coordinated with current Marine amphibious landing. As soon as a beachhead is secured, the SATS task force at about 25 LST-type ships will move in and unload the equipment. All equipment can be unloaded in Lockheed C-119s or C-141s.

As components are being unloaded, Seaborn or Marine equipment will level a dirt bed for the runway. Matting, which has a rotating wheel attached to the tape reel and the other locked in place, would be used to stop the tape reels.

As soon as the dirt bed is leveled, the SATS task force at about 25 LST-type ships will move in and unload the equipment. All equipment can be unloaded in Lockheed C-119s or C-141s.

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wing rework
saving
\$2.8 million!



Billed Bolts being installed in BF100 lower second skin covering main torque box after being removed from rework (2 of 4) Shear Corp. portable power units (BF4000 electrically operated model shown) provide hydraulic power to the Billed Bolt Gun. An operator model is non-sparking and safe for use near fueled aircraft or the ACS ready vehicles.

INSTALLATION TOOLING



Because of its ability to fill sawn-off or oversized holes, the all-purpose, glued Bolt fastening system has become an essential part of a method developed at Hill AFB, Base in Ogden, Utah, to repair wings of A-101C fighter as a result of depot level maintenance.

Since the unique repair method replaces only the opened panels rather than entire wing structural assemblies, an estimated \$2,875,021.00 was saved during first year of a continuing program. With similar conditions, this method is applicable to other type aircraft, nacelle and space vehicle structure.

At first, engineering analysis indicated that major repair of the damaged wing panels was not feasible. Because of the problem of stitching the hole patterns and varying tolerances between the original wing structure and the new fuselage panel, and yet retain the wing's original "feel," the wing needed considerable repair. Complete replacement of the wing seemed necessary to fix the pronounced control issues.

Fortunately, a basic method was developed by Mill engineers and shop technicians to transfer the exact hole location of a damaged wing spar, to a piece of a drill blank and ported drill bushing according to a hole location diagram. The taper then was drilled with a twist drill bit, ground, polished, flattened with flined flats to the exact procedure. When finished, the reworked wing showed no evidence of distortion. Thus, the repair was accomplished for the price of a thin panel rather than that of an entire wing structure.

For repair or modification, range of Blind Bolts and Blind Nuts reinstates structural assembly. For production, they are useful for tight structural areas, close-off panels and tubular members. For replacement purposes, self-locking Blind Bolts and Nuts match strength values of NAS bolts and nuts. And, resistant to stress work, Blind Bolts are not stress sensitive.

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USAF Tests YC-123H on Soft Field



Antonov Scores Soviet Sports Authorities

Moscow—Russian aircraft designer O. K. Antonov has charged that top Soviet sports authorities can be getting ready to back out of the 1963 World Gliding Championships in Argentina because they are afraid of what may happen if their entry are beaten.

In another of his polemic against Russian bureaucrats, Antonov alleged that members of the Central Committee of the USSR's top government-controlled, state-run DOKSAF sports organization would rather be "choked" for not permitting a Soviet team to compete than expose themselves to the unknown consequences of sport using a Soviet team.

Antonov, who is a member of the President of Russia's All Union Federation of Aviation Sport as well as a deputy to the USSR's Supreme Soviet, expressed his indignation in an editorial article for the newspaper *Kommunisticheskaya Pravda*.

The Russian undersecretary's article, on DOKSAF (Voluntary Society for Aviation) the Army, Air Force and Navy is deleted.

"I would like to continue the discus-

sion began in the article *Pinkholes in the Airfield* and try, with the aid of the public, to have our aviation sport from yet another defeat before it is too late.

In 1959, the A-15 airplane—a craft designed for getting around—was built for DOKSAF glider pilots. Young de-

signers-enthusiasts working in cooperation with personnel of the Antonov aircraft factory at Kiev put all their zeal, knowledge and love into the project," Antonov said.

"The A-15 glider was designed, built and thoroughly tested in a short period of time—one year—so as to ensure our gliding team's participation in the . . . world championships in 1962."

"However, when the Central Committee of the USSR's DOKSAF received the questioning glider they decided that there wasn't sufficient time for pilots to master them. They apparently concluded that our glider pilots could not do so well competitively in the A-15s."

"So DOKSAF's Central Committee refused to participate in the world championships that year. Meanwhile, only two days after this poorly-founded decision was made, M. Vorobievskiy, a member of the Soviet team, set a new world speed record of 211.5 km/hr for the 100 km, closed triangular course. This feat was then established by an American."

"Soon afterward, yet another Af-

gano Soviet speed record was set for a 100-km course."

"That same summer, A-15 gliders captured two more world and four All Union records. And glider pilot Vsevolodov, flying an A-15, took first place in competition in Romania in collecting a perfect 1,000 points."

"Thus the flying and technical characteristics of the A-15 were discussed several times again, even during flights with light thermals."

"It was not because of insufficient experience in international events, plus poor organization of team training and careless preparation of the team for competition (for example, the lack of a radio equipment specialist on the team) that we lost the team championship in the 1962 international gliding contests for socialist countries."

"Now February's World Gliding Championships will be held in Argentina. A-15 gliders have been fully prepared for the flights."

But the directors of DOKSAF's Central Committee have stoned to water again.

"They say 'Look what might happen! This year our radio-controlled model airplane enthusiasts, our para-chutists, and our sport plane pilots did considerably more than they were capable of doing!'"

Yes, this is all true. But what has that got to do with our glider enthusi-

asts, who have demonstrated their fighting ability? by doing?"

"So what is the way out of this blind alley? Just what is to be done? In the future, contests will be held in Canada, France, India, Australia or some place else! In those places there will again be unfavorable conditions! Again there will be disaster!"

Wouldn't it be better to sit quietly and simply at home and wait till the officials fly to us? This is a rather strange notion of progress! Soviet sportmen were not afraid to enter the Olympics at Helsinki for the first time—and they did well. Then later in Melbourne and Rome their participation resulted in a genuine triumph for the sports flag of the land of the Soviets.

But apparently, in the Central Committee of DOKSAF they remain like this: "If you don't participate, you get choked a little and, perhaps, you can't be praised for your predecessor. However, if you participate and, God forbid, you don't come in first, what will happen?"

"And, by that reasoning, the fact that we are not accumulating experience in international competition (the USSR's team still has not been represented in the world championships, which have already been held seven times in the postwar period) can only be regarded as a good thing. It will be something

that can be brought up as an excuse for not participating once more in 1965."

"The question arises: How long will our sport of gliding be run by people who do not love it ardently?"

Russia Boosts An-14 Power and Wingspan

Russia has put more power in its inter-engine An-14 "Pchelka" (Little Bee) light transport. The new AN-14MF radial engines are rated at 300 hp, compared with 250 hp for the AN-14a previously employed in the Antonov civil (AWJ Jan. 4, p. 48).

Wingspan apparently has also been increased from 65 to 72 ft.

The "Pchelka" has undergone an engine modification since it was unveiled in 1957. The many changes have greatly delayed its introduction into regular passenger, agricultural and other services.

Antonov said a seven-passenger version of the An-14 will have a 600 kg (1,323 lb), gull-wing for distances up to 600 km (375 mi.). For short hops up to 200 km (124 mi.) the "Pchelka" can carry nine passengers and a 750 kg (1,653 lb) payload.

With maximum fuel load and a 550 kg (1,212 lb) payload, range can be increased to 728 km (447 mi.)



THE FLIGHT OF THE HUMMINGBIRD

This is the new XV-4A (formerly the VZ-10) Hummingbird now being developed for the U.S. Army Materiel Command by Lockheed-Georgia. It has been flying since July 7, and is progressing successfully in its flight-test program.

The Hummingbird, as the name suggests, will take off straight up, land straight down, hover, then dart away at speeds up to 300 mph. It combines—with simplicity—the characteristics of a helicopter and a high-speed jet. Missions: to work

In the air for the Army a year from go-ahead

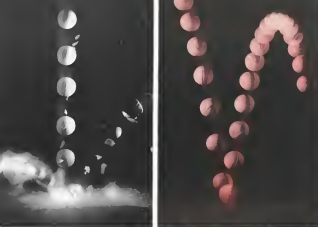
directly with the troops in performing surveillance and other missions.

The principle of the Hummingbird is a system of ejector mixing chambers in the fuselage, fed by high-velocity exhaust from twin jet engines. In

vertical flight, gases are directed downward through bomb-bay-type doors. In conventional flight, these doors are closed and forward thrust is provided in the normal manner.

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AFOSR Grants

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Acheson Hughes Laboratory, Baltimore 15, MD—\$45,000 for high resolution studies in the far infrared.
University of Washington, Seattle 98195—\$10,000 for study of theory of molecular electronic spectra.
University of Minnesota, Minneapolis 554 260, USA—\$40,000 for study of complex interaction between magnetic and induced fields in superconductors.
Lab. of Minnesota, Minneapolis 554 260, USA—\$10,000 for study of photochemical bond cleavage in organic compounds.
University of California at Berkeley, Berkeley 94 720—\$10,000 for study of fluid dynamics of a supersonic gas flow in a pipe from hypersonic flow.
University of California, San Diego 92093—\$10,000 for research in the field of photochemical bond cleavage in organic compounds.
University of California, San Diego 92093—\$10,000 for study of photochemical bond cleavage in organic compounds.
University of California, San Diego 92093—\$10,000 for study of photochemical bond cleavage in organic compounds.



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A fuel cell for Apollo

This is a model of a fuel cell designed by Pratt & Whitney Aircraft—the company chosen to develop a fuel cell system for Apollo, America's first manned lunar craft. The Apollo spacecraft will be built for NASA by North American Aviation.

The hydrogen-oxygen cell will supply power for environmental conditioning, communication, instrumentation, and scientific equipment. In addition to generating electricity, the fuel cell will provide water for Apollo's three-man crew.

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lookout. Continuing to roll down its longitudinal axis, the aircraft circled the area coming into the ground 550 ft beyond the point of last report, and landed 190 ft up. It then did full rate another 430 ft. The aircraft disintegrated through cut at 10 ft, and wreckage was strewn over an area 200 ft wide and 1,100 ft long. Evidence of ground fire was found at various points along this path.

Impact occurred on aspect roughly about 1,500 ft above and to the right of the end of runway 14R, about 100 ft north of Irving Park Road. Also rising beyond the railroad subdivision the aircraft was 100 ft above the road. In most of the circumstances because of trees and other obstructions immediately thereafter a large number of unreported flame accompanied by heavy black smoke was seen. Two of the reports were included as 0017. The aircraft was determined to impact and fire. All occupants were fatally injured.

The weather at time of takeoff was: sky clear, visibility 8 mi., smoke and haze, wind southerly at 4 kt, temperature 99F, dewpoint 52F, altitude 10 ft.

Runway 14R is 11,600 ft long. Airport elevation is 602 ft and The Chicago Northwestern Railroad tracks are adjacent to the southern boundary of the airport. These tracks are on a fill at 60 ft, slope 20 ft above the ground toward the runway. Each of the two positions in front of the fill consist of three heavy wires carrying 10,000 v.

Members of the crew which operated N 15705 on its final post jump to the airport testified that no operational problems were encountered and that no mechanical discrepancies were noted during these flights. The Northwest Airlines crew chief also performed the pre-flight check on N 15705 after its arrival at O'Hare Airport, and who also accompanied the outgoing flight against a scheduled inspection of the aircraft, stated that it was necessary prior to its final flight. A review of company and Federal Aviation Agency records showed that all crew items had been checked and qualified to operate the Lockheed L-1049. Dispatching of Flight 700 was found to have been correct and in accordance with company operating procedures.

Most witnesses indicated that the flap were down to some degree at takeoff and that the landing gear was retracted after lift-off. All agreed that prior to impact with the powerlines there was no fire or smoke seen. Nothing was observed to appear or fall from the aircraft, no loads were seen in the flight path, and no abrupt pulling or violent control action in the steep bank was observed.

To assist in developing a flight profile based on actual disposition of debris as well, investigation of the impact of four meteorologists conducted a survey of 44 debris blocks. These blocks were sampled to recover and were all observed when using runway 14R. The survey also showed that the average lift-off was made when these aircraft were approximately 4,000 ft above the runway, and that when they reached the 2,000 ft marker they climbed and angled steeply; they about 210 ft and 110 ft respectively. The ac-

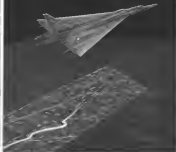
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VENUS CALLING: MESSAGE 1

Marsden II, this nation's most sophisticated deep space probe, will give us our first close look at Venus. Yet, the signal from Marsden II will be only 1/1000th as strong as the signal from the big dish antenna at Goldstone, Calif.

They speak of the magnitude will be amplified by the new MEC master which Jet Propulsion Laboratory will install on the antenna. This traveling wave master designed for field operations operates in a closed cycle regenerative and provides 25 db gain in 5 bands at a temperature of 42° K. Operationally designed and developed by the R & D department, the MEC master is available on the open market with this combination of features:

Other MEC masters offering up to 30 db gain over a 300 Mc bandwidth and a 30 Mc instantaneous bandwidth are available for L, C, and X band operations.

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that the cable had a certain tendency to sag and recover from its lifting.

Full motion ground test performed at Lockheed Aircraft Corporation and well used by Royal Astronomers was one which simulated failure of the left ring drive of the cable as an electric motor. With hydraulic pressure applied, lower engaged, and allowed to retract, the cable, identified as the silver cable coming from the wreckage of N 13705, was reeled with a pair of rollers.

The person holding the control wheel felt only a slight pull when the cable was out and was not otherwise aware of what had occurred. When the cable seemed to be completely reeled in, the cable was reeled in completely until the right ring drive down movement showed that the trailing edge of the silver had moved on under above its normally fixed position. When the control wheel was then moved to the left ring drive position, the slack in the left ring drive cable caused the cable movement to lag on its normal structure.

A review of the manufacturer's records showed that N 13705 was manufactured June 16, 1960 that the Lockheed Electron Program, a major structural modification, was completed January 11, 1961 and that its last complete flight test was performed June 27, 1961.

On June 12, 1961, the capsule was disassembled and destroyed in a test at the Lockheed Aircraft, Inc., and was placed into service on the same date.

Alison Trouble

From June 22 to July 11, 1961, eight electric control disintegrations were entered in the monthly logs of N 13705. Most of these disintegrations reported sluggish bell in silver boots, delayed reaction in silver boots, sticking or heading of silver boots, poor or silver boots at all speeds. Although two pilot readings indicated the need for an in-flight check, examination of the records failed to disclose that on a flight shortly after launch was made. In one instance the pilot entered the word "OK" on ground.

The controller action entered in the log was, "checked silver boots as when for disintegration with flag extended a head O.K. for further observation." In the other instance the pilot's report was, "on all as test on the ground—check on field conditions." The controller action shown in the log was, "checked silver boots pack up OK for further observation." Most of the controller action reported indicated the performance of ground checks, no entry showed replacement of the silver boots and hydraulic check but one log showed only the boots were "tested." During that period of time the aircraft continued to be disintegrated on a total of 20 flights.

On July 11, 1961, the month was placed in the Northwest Airlines maintenance records at Vancouver, B.C., in which a letter check, lower the silver boots, the cable was still maintaining itself it was decided to also replace the silver boots as well. Considering the letter test, the three control company maintenance entries required that the Lockheed Electron master manual, which presented the steps for the removal and replacement of the silver boots assembly, be followed by these performing the work.

A Northwest Airlines maintenance manual required that the Lockheed Electron Tag Form OM 240, be attached to personnel receipt records. The receipt of this tag was to be given to the person in charge of the aircraft when such action is advisable in a diagram during the performance of maintenance operations, and to present evidence of an aircraft for dispatch when completed with repairs as an acceptance place. The document also provided that upon completion of the task, provided it has been satisfactorily performed, an inspection will sign the tag and return it from the aircraft. A guarantee from this document explicitly stated "under NO circumstances shall the tag be removed from the aircraft before the tag is properly signed by an inspector." The document further provided that a receipt of the tag and the tag log should be attached to the tag and must be signed.

A separate section of the current maintenance manual, specifically highlighting the possibility of uncompleted work, regarding a shift change required the use of the Lockheed Electron Tag when entering safety work items on the aircraft. On June 27, 1961, an aircraft maintenance record dated June 21, 1961, signed by the Chief Mechanic and the Senior Supervising Inspector, contained no maintenance work items on the aircraft during July 1961. Paragraph 18 of the maintenance manual stated that when a flight control is changed or removed and installed as a "service" check, an inspection follow up on the installation and sign has to be in the log book. Because no silver boots assembly is a major component of a flight control it is evident that this paragraph applied to the silver boots assembly.

Since the silver boots assembly was changed on N 13705 was the first such job to be performed as an Electric control by the current maintenance personnel personally supervised. The Bureau was informed the most recent incident that it believed this was the first boot package change in which the silver boots were changed. On June 27, 1961, these boots were replaced throughout each 24-hour period. Shift L, from 8:00 a.m. until 3:30 p.m.; Shift 2, from 3:30 p.m. until 11:50 p.m.; and Shift 3, from 11:50 p.m. until 6:00 a.m.

Removal of the malfunctioning silver boots was accomplished by two mechanics of Shift 2 on the night of July 11. One mechanic was occupied with other aircraft during most of the shift and worked on the unit from 11:50 until 1:00 a.m. when the other mechanic performed most of the removal work. Both testified that



Bell Demonstrates Nord Missile

Nord Aviation, CT-40 experimental target missile will be demonstrated to U.S. Navy by Bell Aircraft Co. under a \$1.5-million Navy contract. Bell will purchase the CT-40s from Nord in Pomona and fly them at the Pacific Missile Range in California. Demonstration and evaluation flight will begin in April.

10

LETTERS

Missing Satellite

Recent Department of Defense directives make the gathering of news of outer space activities an extremely tedious matter at best. You are, therefore, to be congratulated on the thoroughness and quality of your coverage of this most significant field.

In spite of these efforts, however, there appears to be no information currently available concerning the space vehicle bearing the international designation 1962 Alpha 21a.

I would appreciate any information you or your readers might have concerning the rebate, as a retail parameter branch data, branch rebate, and counter of units.

Thank you

☐ Savings
☐ White House M. V.

[United Nations intelligence agency and the National Aeronautics and Space Administration's satellite tracking system both lost 1962 Alpha 66. Presumably it was a 600-kg attempt to launch a spacecraft on a Venus 66 in mission. It was probably a backup to the unsuccessful Soviet Venera probe launched Sept. 1. This was one of six failures mentioned by NASA Administrator James E. Webb. Since Alpha 66 is also listed as no object launched by the US on Sept. 17, the missing Alpha probe apparently was launched between Sept. 1 and Sept. 17.—Ed.]

Human Element

In AW Oct 79 (p. 118) Capt. Herb Skelton is his professional career concerning the recent and/or plot "mushrooms" and in AW Nov 15 (p. 114) Flight Engineer Whitehouse criticized further support in his "Cashed Cancer Paper" letter. The general endorsement of the much-maligned plot by these two types is a source of much gratitude to those of us who do not have a working knowledge of what transpires behind the closed cockpit door but who nevertheless, we think concerned—the online community.

[illegible]

Since the advent of this so-called "open" I have heard much comment from my fellow travelers, but none of it indicative of any loss of confidence in today's flight crew. Neither do I see any smoking bans because some portion of the passenger community has run off to Moscow to other forms of

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Interpretation: Other than some multi-typing at colonized bacteria, we still continue to rely on one test with no thought that the professional efficiency of the light test is being compromised. We recognize that the culture light tests are going through a slow transition, but neither side could win war as we are attempting to migrate the other's devotion to data via the data and code.

There must be the day when the man does passages could wander up to the front and while in flight and exchange glances when trying to absorb all the action was almost during a certain crisis. Capt Hirth and Mr. Walschleben, from the inside have recommended what most passengers have shown. Thought despite the fact that recent concentration requires the day to be looked

As regards the actual fact of pilot-beer relationships it appears chaotic: first of all there has been proven to that the front end let him not become after all, wouldn't want any other lead.

For 140 T. Serrano
Endorsed: Luis Riquelme
Accepted: General Corp.
Jackson Heights, N. Y.

With all the recent resolutions of weapons put downguns should the nation can't help but wonder if the CNS will ever give "showdown case" in the same future as an overall incident.

Item Available:
Hard Model Car
Chevy, 1961

Family Plan

Let me quickly second the suggestion of Bill Miller (NYC Dec. 1, p. 154) to the authors to come up with a low cost family plan. As a daily heavy user (700,000 and in 19 years) I have not been on full flight 5% of the time, accurate statistics are of course, available.

Just a past propensity of love
 travel is the movement and not to meet
 a particular love of mind, my suggestion

1. A family intent to cook fall has her Dad and Mother for about 600 a mile north and children at 10 a mile north. (This brings the total cost quite close to gasoline, two, motel food, special repairs to the car, for a trip, and more allowance for a day saved for a family of three or four. Table 1)

2. The family index would be for a contest day, but not necessarily a particular fight. Thus maybe Dad and one kid would go out on the first fight and Mother and the others on a later fight. Possibly would move up so that the family is united by the end.

The show would get the family together at midnight 502 to 602 on week (at most) after a coffee hour or two (right instead of dodging traffic for 10 h). In some cases they would be at the beach by 8 a.m., and always half the family would be there by then.

Alan Dunn
Allentown, PA 18106

Halaby Scored

There seems little doubt that Mr. Halble (United Nations Agency) should recognize that the action is done here with the other countries, (right answers). Supportive with his action in passing information and analysis traced potential in the subject of today's hot and complicated work.

You know, our methodology is reinforced and toward our member as today's first month has a tendency to reduce the efficiency and productivity of all our members in the last player's toward will be delayed from their delay to determine that an methodology toward our member is

doing his duties properly. It seems a shame that he could not have conducted himself in the same exemplary and determined manner that Mr. Quinlan did. His personal conduct was always solid. He never hesitated

I hope this system has the same motivating drive to increase safety at all costs as did Mr. Cossentino.

Country	TI	Expend.
Norway	10	1

Non-Pro Pilot

Contents for air traffic system scans the nonprofessional pilot (NPP) Qor 75, p. 181. When values flight decks fall at professional are entered under in repeated and improvements of the system when the full worth of the FAA (or more, a self-propelled line or fabric) depends on the fullest winged pilot, who understands in systematic growth at many winds permeate in "conductor-see," the system is further.

the shortest time between
your origin and destination, call
it t_{ij} . If you get caught in a
jam on I-95, walking about as
slowly as the tortoise, the period

Let's face it. Nonprofessional living is being selected and crushed out of the

James Earl Ray **Prison**
San Diego, Calif.



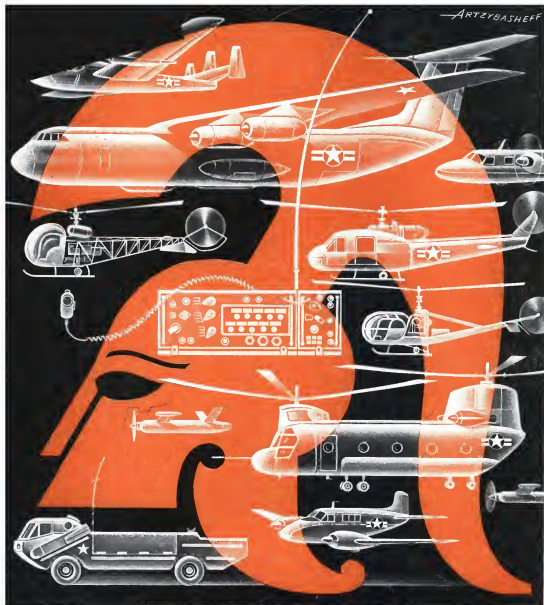
No. 1 in Rotating Components

Leadership. What is it? Here are some criteria we will be happy to be measured against.

Pioneering + widest variety
of types + consistent high
accuracy in production

quantities - all around quality
lled and experienced o

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